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# Electrical World

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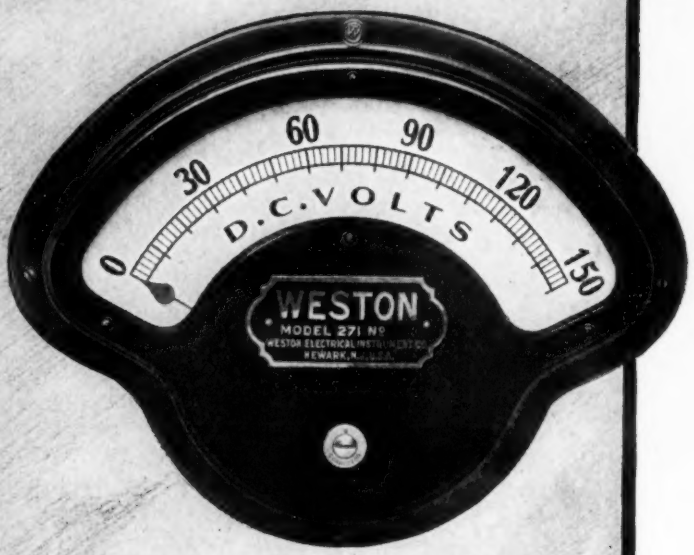


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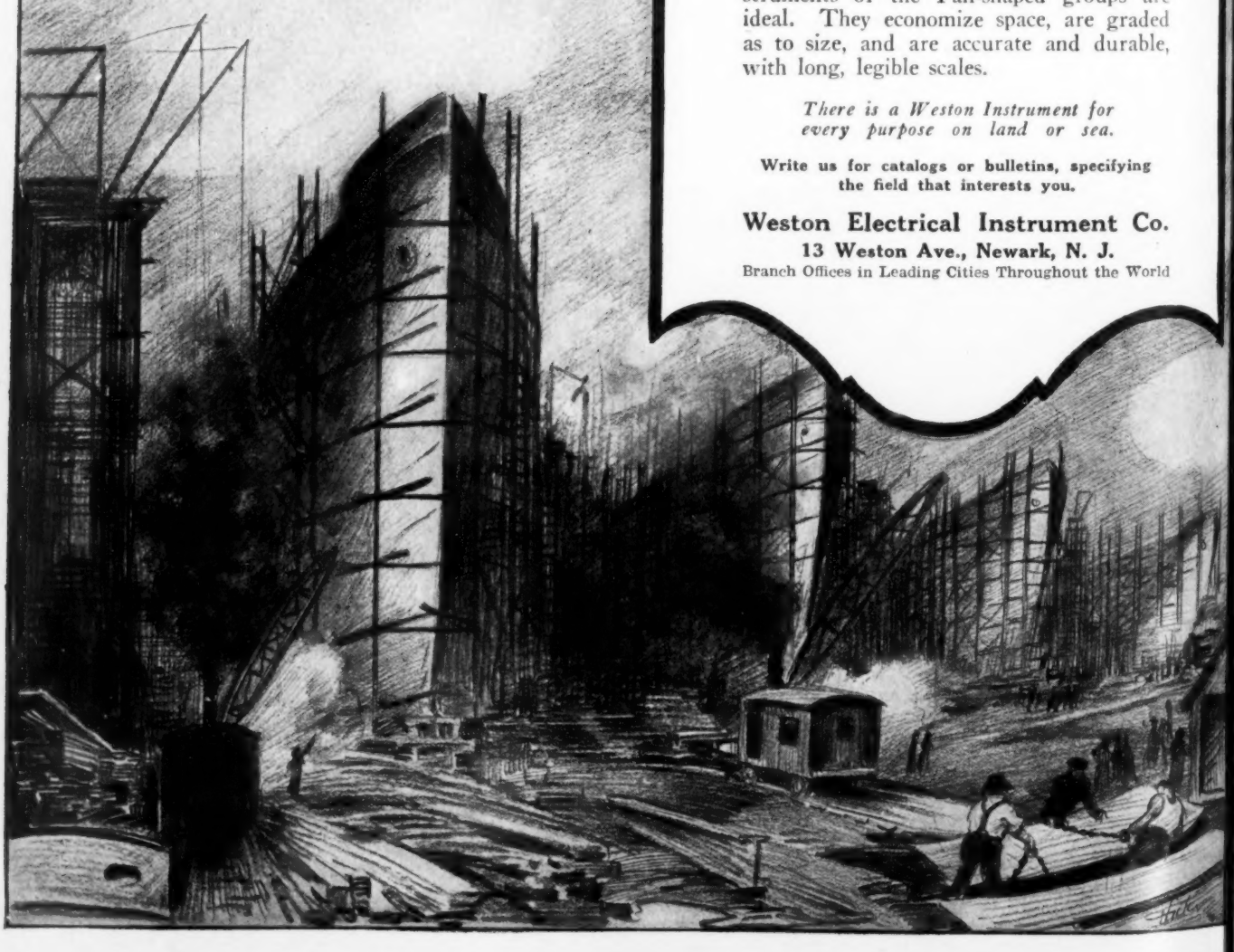

# Electrical World

*The consolidation of* ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

*Volume* 74 New York, Saturday, October 4, 1919 *Number* 14

## Load Factor of Public Buildings

DISCUSSIONS of street lighting rates often involve public buildings, and it is well for managers to bear in mind that many of these have a wretched load factor and require the maintenance of idle equipment capacity twenty or twenty-five nights a month, with occasional spasmodic demands up toward the maximum of the connected load and only a nominal nightly consumption of energy. Under such conditions it is hard to see why a city or town should expect to receive a rate differential, and it is more than probable that the practice of applying regular commercial lighting rates to such installations can be sustained before a fair-minded utility commission. In cases where the renewal or preparation of a public lighting contract gives rise to political or other ill-advised attacks upon the rate structure, it behooves the central-station manager to make the most of his opportunities to analyze the economic conditions governing such service and to place them clearly before all parties in interest.

*State conventions will do well to insert planks in their platforms to the effect that going out on strike by a public utility employee is a crime against society. Whoever enters quasi-public service should do so with the clear understanding that loyalty to the operating organization must take precedence over the so-called interests of outside affiliations capable of becoming injurious to the general welfare.*

## Daylight Saving

THE passage of the bill repealing daylight saving over the President's veto has left things in a very pretty muddle, for divers urban communities are making vigorous efforts to retain summer time quite irrespective of the repeal. Frankly, the question is squarely one as between country and city, since there is no doubt that the denizens of the former, and particularly farmers, never liked the change, however grateful it proved to be to those who work in large communities. As an economic matter daylight saving showed very meager results. Here and there was a perceptible reduction in the use of light, but we are inclined to think that in view of the continuance of daylight saving through October the net result in the reduction of artificial lighting in even brief series of years would be very small, much smaller than some preliminary figures indicated. At all events, the lighting industry is not sufficiently affected to get in the least excited over the matter.

A really serious side of the situation will appear, however, if local authorities go in for daylight saving on their own account; for one thing is certain, that the railroads will not be permitted under existing circumstances to run on summer time, and without their active coöperation local daylight saving is likely to produce a serious mix-up. If there is gain to the community in the daylight-saving plan great enough to justify a systematic effort at least in the larger cities, it would seem best worth while frankly to shift business hours at a suitable time of the year, leaving the clocks and the railways to pursue the even tenor of their ways. Early closing in summer is becoming rather the rule than the exception, and if carried out systematically would gain all the material advantage of a change in clock time. If the game is really worth the candle, such a shift in hours ought to be carried out with comparative ease, leaving everybody reasonably happy and contented, from the farmer whose "critters" go on sun time whether he likes it or not to the clerk or professional man who enjoys an extra hour of daylight on the golf links. In any case we doubt the desirability of carrying a change either of habits or of clocks clear through October. It would certainly be of psychological interest to discover whether people really care enough about the added period of daylight to adjust their ways without solemnly humbugging themselves by changing the clocks.

## Future Influence of N. E. L. A. Sections

IN THE same indomitable spirit that won for the central-station companies of this country a most successful service record during the war, the new problems of the industry are being attacked. The organization of the National Electric Light Association into its geographical sections is proving more and more effective. The work laid out for the future as revealed in the recent conventions of such sections indicates that these units are to have an added influence in shaping the future policy of the national body on matters of nation-wide concern. Prominent among the present problems is the reduced purchasing power of the gross return from service when applied to the operating accounts of fuel, labor, supplies and similar commodities. Special taxes constitute another new burden, with the local complication of assessments being made on present values of utility property. Local co-operation and discussion with regulating and other state authorities on such problems through the medium of the N. E. L. A. geographical sections have already proved their value to the industry within the sections themselves, and it is encouraging to realize that such work will be of greater value to the parent body in the formulation of policies for the future.

## Stage Lighting and Control

IN his article on "Remote Control for Theater Lighting" R. E. Major describes some improved methods for this purpose. The installation in the Chicago theater is considerably simpler in design and operation than that used in other theaters, such as the Century Theatre in New York City, which was and probably still remains the most complicated example of stage wiring and stage switchboard control in existence. But as long as old methods of stage lighting are employed to meet the requirements of modern dramatic productions, methods of controlling the circuits are certain to become more and more complicated, necessitating some form of switchboard of the type described by Mr. Major, if the operating force is not to be greatly increased.

The need for remote control in stage switchboards, however, is problematical; for, after all, the complexity of the switchboard is directly related to the complexity of the lighting installation. Stage lighting and its control ought not to be considered apart from the stage setting. All three should be worked out together if satisfactory results are to be achieved. No fixed or rigid form of lamps giving always the same general distribution of light intensity can be said to fit the multiplicity of conditions imposed by modern stagecraft. Instead the setting and lighting require the use of flexible equipment divided into units that can be assembled in any desired manner to produce results. No matter how complicated a stage production, the lighting equipment need not be elaborate if tl is flexible, and the results achieved from the use of flexible equipment are invariably superior to anything that can be accomplished with the use of the usual rigid stage-lighting devices and permanent wiring.

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*The electrification of the household proceeds at a pace that warrants the most optimistic attitude on the part of the manufacturer, central station, jobber and contractor-dealer. Who will wager that 1919 will not exhibit the best year's sales yet in domestic electrical conveniences, and who dares assert that 1920 will not "go this year one better"?*

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## Running Mercury Rectifiers in Parallel

WE MAY take it for granted that, no matter what developments in the alternating-current field are reasonably likely to occur, there will always be a demand for direct-current supply. This means that, with large alternating-current generators installed in central stations as the primary source of electric power, converters will be necessary for exchanging that power from the alternating-current to the direct-current type. There are two main types of converters, to say nothing of the electrolytic variety, namely, rotary converters and vacuum rectifiers, the latter including mercury-arc rectifiers. At the present time the rotary converters have the conversion field almost entirely to themselves, although vacuum converters are used extensively in connection with battery charging and street lighting. It is common to see rotary-converter stations with thousands of kilowatts of capacity. It is rare to see a vacuum converter of many kilowatts capacity. Nevertheless, one cannot help wishing and hoping that this situation may ultimately be reversed. Any one who watches the two different types at work cannot fail to be impressed by the contrast. In the large machine there is much expensive plant and workmanship with need for oversight, oiling and inspection. There has to be trained attention for starting and stopping. In the vacuum tubes the operation is quiet and almost without inertia. There is no oiling or acceleration. If vacuum-tube rectifiers could be designed for thousands of kilowatts in output, it is readily conceivable that they could be left locked up in substations, to operate automatically for weeks together.

Various attempts have been made, both in this country and abroad, to construct large vacuum rectifiers. Some of these attempts have been fairly successful. The prospects of large-scale rectification may not be very remote. In a recent number of the *Electrician* descriptions are given of a Swiss company's mercury-arc rectifiers supplying as much as 500 amp. of direct current, so that by operating these devices in parallel it is possible to obtain outputs up to 1000 kw.

If such mercury-arc converters can be made reliable up to high voltages, we may expect to see large electric railway converters in small substations, without rotating machinery.

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*Price changes would cause less disturbance if they were oftener accompanied by a fair measure of cost data. Public utility costs are being thrown open to the world in minute detail, and it should be feasible to set forth at least the basic data when the consumer is asked to pay more for a product.*

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## Variable-Speed Alternating-Current Motors

THE advantages of alternating-current generation and distribution over direct current are now well known. It is hardly an exaggeration to state that were a satisfactory variable-speed alternating-current motor available in small and medium sizes, practically all direct-current plants would in a few years be replaced by alternating-current plants. It is not the necessity of three wires against two that prevents a general introduction of alternating-current motors in mills, shops and factories. It is the essentially constant-speed characteristics of these motors that makes their universal application difficult. A really adjustable-speed alternating-current motor, whether single-phase or polyphase, necessitates a commutator and in the present state of the art is much more expensive and probably troublesome than a direct-current motor. This is not inherently so, and as a matter of fact polyphase commutator motors had reached a considerable degree of perfection in Europe just before the war. A number of combination sets consisting of an induction motor and one or more commutator motors for speed control (Scherbius system, Kramer system, etc.) have been developed in Europe and later adapted to our American conditions for driving large rolling mills. Their operation is said to be eminently satisfactory, but they are applicable in large sizes only. For medium sizes there are induction motors with double windings by means of which the number of poles may be changed, and the resistance control in the rotor circuit.

The polyphase commutator motor seems to be the real solution of the problem, a solution which is well under way, but which will still require a great deal of careful theoretical reasoning and experimentation before the motor may be intrusted to the rough treatment of an average factory operator.

## The Super-Transmission System

THE Institute paper by Messrs. Sorensen, Cox and Armstrong read at the Pacific Coast Convention recently is an interesting forecast of the possibilities of a transmission system on a gigantic scale, based upon the systems already operating in California. Enough data have been accumulated from the high-tension lines in service to bring the present project within reach without serious extrapolation. Within the next six or seven years, to judge from present data, the demand for electric power in California will pass 1,000,000 kw. capacity, more than double the present requirement. Looking at this problem in the large, it means that with a unified system future power development would be in large units, and, the distances being great, it would become necessary to play the limit in voltage.

The authors of this paper take up the situation in this broad spirit and present some important conclusions. They assume interconnection of all the existing companies as an economic necessity, the proposed linkage being a two-circuit transmission system extending from Pitt River in the north to Los Angeles, the present Big Creek lines being taken as one of the existing links of the system. A further branch of the main transmission line would extend eastward to Phoenix, Ariz., making the total length of the transmission bus approximately 1100 miles (1770 km.). The development sketched out would call for a total capacity of about 1,500,000 kw. to be derived from plants old and new.

The voltage suggested for the project is 220,000 volts, as against the 150,000 volts already tested out in the Big Creek system. We are inclined to think that somewhere near this figure will be reached by the next big project, wherever it may be, since the insulation difficulties in these days of suspension insulators are sufficiently in hand to permit such an increase in working pressure. In more than five years' experience with the Big Creek system the failures of insulator strings have been almost negligible, and a moderate increase in the number of units per string—or, perhaps better, a redesign of the units—would enable the higher voltage figure to be reached with comparative safety. The question of corona is a more serious one, since under storm conditions the losses might become troublesome locally, either directly or through indirect influence on the insulating system. It would be desirable to try out coronal effects on a somewhat larger scale than has yet been the case as a guide to desirable construction and to insure an adequate factor of safety. Of course, the charging current of such a line as that proposed if it were a straight-away transmission would be a very serious matter, although it can be dealt with successfully by synchronous condensers; but as the proposed scheme would actually be built up it is more than likely that local conditions would simplify the actual regulation for charging current very considerably. Indeed, regulation would have to be worked out as a local problem, and in point of fact the complete project would have very different characteristics from a straight 1100-mile (1770-km.) transmission. It is a bold scheme on its face, but it bears the stamp of practicability so far as the engineering features are concerned. The difficulties are really the financial ones, in getting the whole demand for the region on all the supplying plants welded into one operative whole.

*Research work must go on with renewed vigor, although the end of the war has removed the stimulus of imminent preservation of nations from direct attack and the incentive to destroy the enemy power. Relentless campaigning against the waste of natural and developed resources is imperative if America is to meet foreign competition, and the deeper understanding of scientific phenomena has a latent commercial value which needs but the touch of the financier and the engineer to materialize. Democracy has made few greater mistakes than to belittle the services of technical experts and "pure" scientists.*

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## Standardization of Steel-Mill Equipment

AN EARLY standardization in any line of work blocks progress. In many respects it is fortunate that standardization of electrical equipment in steel mills has been so long deferred. The freedom of selection of voltages, types of motors and control, lifting magnets, wiring and so forth has allowed a free display of ingenuity and initiative on the part of both mill engineers and manufacturers' designers. The feverish activity of the steel mills during the war proved to be an acid test for the electrical equipment, and it stood the test splendidly.

Few outsiders realize the importance of electricity in steel mills, but a visit to a modern plant impresses one with the fact that practically all motive power measured in ten of thousands of kilowatts is electrical. Iron ore is moved in the horizontal direction by electric locomotives and is lifted and charged into blast furnaces by electric cranes and cars in the form of cast iron. The charging of Bessemer converters or open-hearth furnaces is done electrically, and rolling mills are driven by huge electric motors. To this must be added hundreds of electric motors driving all kinds of auxiliary apparatus, tables, blowers, machine tools, pumps, compressors, etc. All lighting is electrical, and a large telephone system also must be looked after by the electrical department. Where steel is made or refined in electrical furnaces many thousands of kilowatts of electric apparatus and auxiliaries are again added.

The existence of a thriving national engineering society under the name of the Association of Iron and Steel Electrical Engineers, with a membership of nearly 1000, is another proof of a tremendous growth of applications of electricity in the steel industry. The time is ripe now, therefore, to begin a standardization of some of this electrical equipment, so as to reduce its cost, to reduce the number of spare parts and to enable electrical engineers in the steel industry to devote more time to new and growing problems. Some mills still use 220 volts for lighting. It would be well for all concerned to decide on 110 volts as the standard voltage and to discontinue a number of items in the equipment made for 220 volts. Then there is much unnecessary variation in the construction of ordinary cranes. It is time to standardize trolley track gages, track wheel drive, speeds of the hoist, bridges, etc., since sufficient experience is available on these points. Unit magneto switches may also be standardized in several respects, as well as the rating of mill motors.

# Calibrating Standard Watt-Hour Meters

## Extreme Accuracy in Testing Portable Standard Watt-Hour Meters by Taking the Revolutions of the Meter During a Definite Time Interval Fixed by an Electric Clock—Details of Electrical Apparatus Which Starts and Stops the Meter

BY F. A. KARTAK
Director Standards Laboratory, University of Wisconsin

A TUNING-FORK device to be used instead of the stop watch was described by the author in an article entitled "Accurate Timing in Electrical Tests" in the ELECTRICAL WORLD for April 5, 1919. In the present article it is the purpose to deal with a fixed-interval timing device rather than a variable-interval timing device. The testing of portable standard watt-hour meters (where it is possible to read the registers in revolutions and fractions) represents a class of testing work in which it is more advantageous to use a fixed-interval method than a variable-interval device for the following reasons:

(a) With a definite wattage load on the meter and a definite or fixed time interval, the number of revolutions which should be made by the meter, if it is in correct adjustment, is at once known, since by properly choosing the time interval and the wattage the number of revolutions can usually be made an integral number and the percentage of error in meter operation can be easily calculated mentally.

(b) It is possible by properly designing the apparatus to eliminate the personal error of the observer entirely by causing the apparatus not only to set off the fixed interval of time, but, by starting and stopping the meter automatically at the beginning and end of the time interval, to replace both the operator's hand and the snap switch in the voltage circuits of the watt-hour meter under test.

### STANDARDS LABORATORY TIMING DEVICE

The fixed-interval timing device as designed and constructed at the standards laboratory is an improved modification of the time-relay-operated test-circuit system (sometimes known as the Boston Edison system) described on page 273 of the 1915 edition of the "Electrical Meterman's Handbook." It consists essentially of an accurate seconds-beating pendulum clock, the pendulum of which, through electrical contacts and special relays, causes the potential circuit of the portable standard watt-hour meter under test to be closed for a definite interval of time.

Fig. 1 shows a simplified diagram of connections of the apparatus which is operated from the clock pendulum. It will be noted from the figure that the pendulum $P$ operates a two-point magnetic contact maker. This contact maker consists of two permanent magnets, one of which is mounted at the bottom of the pendulum bob, the other being mounted below its mate and being pivoted just below its center of gravity, so that as the pendulum swings back and forth the lower magnet is dropped first on contact point $C$ and then on contact point $C'$, in each of which positions it remains until picked up on the return stroke of the pendulum. (See Fig. 2.) On each right-hand stroke of the pendulum, relay $R$ is magnetized, which closes the relay contacts and causes the electromagnet $M_2$ to be energized by battery $B'$. This, in turn, causes the armature of magnet $M_2$ to be thrown forward one step. On the shaft upon which ratchet wheel $R_a$ is mounted there is found an insulating selective switch $S_w$, upon the edge of which are mounted contacts $K_1$ and $K_2$. Connection to these contacts is made through slip rings by means of contact fingers. Thus on every right-hand stroke of the pendulum $P$ (or in every other second) ratchet wheel $R_a$ is stepped forward one step, so that at some certain instant contact segment $K_1$ will be moved under contact finger or brush $f_1$. On the succeeding left-hand stroke of the pendulum and consequent connection between magnet $M_1$ and contact $C'$ current will flow from battery

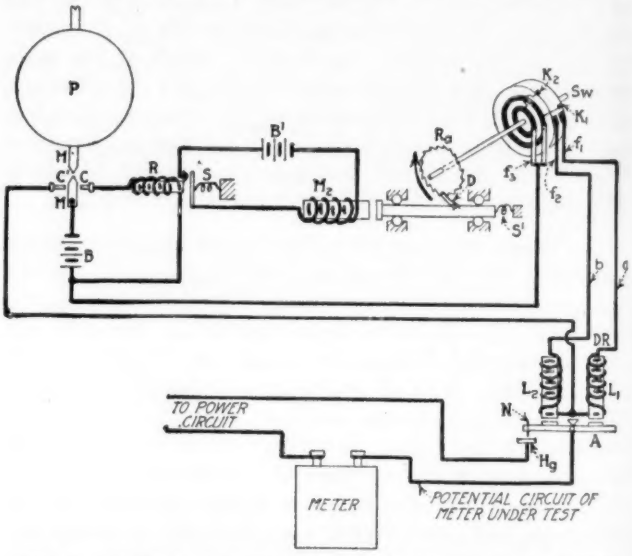



FIG. 1—DIAGRAM FOR TIME-INTERVAL-TESTING APPARATUS

$B$ through contact finger $f_3$ to contact finger $f_1$; thence through magnet $L_1$ of the differential relay $DR$, and thence back through the contact $C'$ to battery $B$. This causes the armature $A$ to be drawn up by magnet $L_1$, which plunges needle $N$ into the mercury cup $Hg$. This contact between $Hg$ and $N$ corresponds to the snap switch in the operator's hand, which is ordinarily connected in the voltage circuit of the meter under test.

To come back to the operation of the apparatus: After this current has been sent through the winding $L_1$ of the differential relay by the left-hand stroke of the clock, on the succeeding stroke (right-hand) contact $K_1$ will be moved from contact finger $f_1$, and nothing further occurs until a certain number of seconds later (which is predetermined by the spacing of $K_1$ and $K_2$ on the edge of the insulating disk), when contact $K_2$ is moved under contact finger $f_2$. (This spacing has been made eighteen steps, or the equivalent of thirty-six seconds.) Upon the stroke of the pendulum which corresponds to the thirty-fifth second this contact $K_2$ will be moved under contact finger $f_2$, so that on the succeeding left-hand, or thirty-sixth, stroke of the clock a current will be sent from battery $B$ through contact finger $f_2$

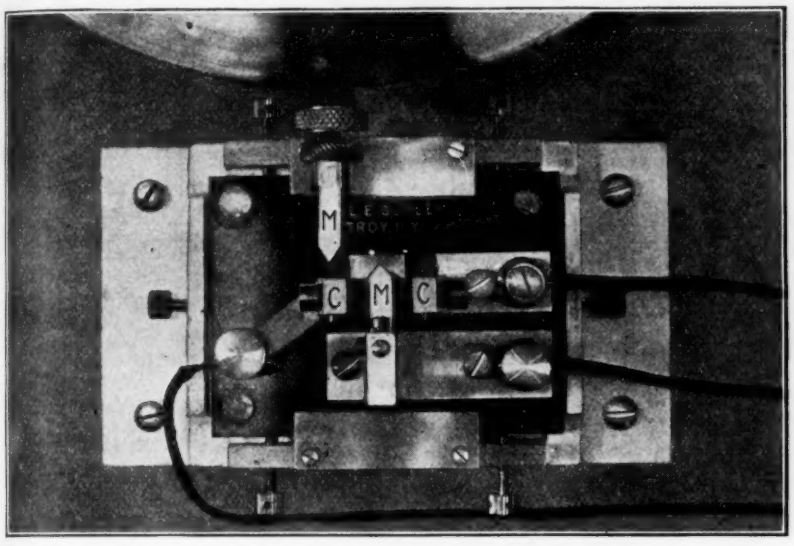
through the magnet coil $L_2$ of the differential relay, and thence back to battery $B$ through the magnetic contact. This energizing of the coil $L_2$ of the differential relay causes the armature $A$ to withdraw the needle $N$ from the mercury cup $Hg$ and thus opens the voltage circuit of the meter under test.

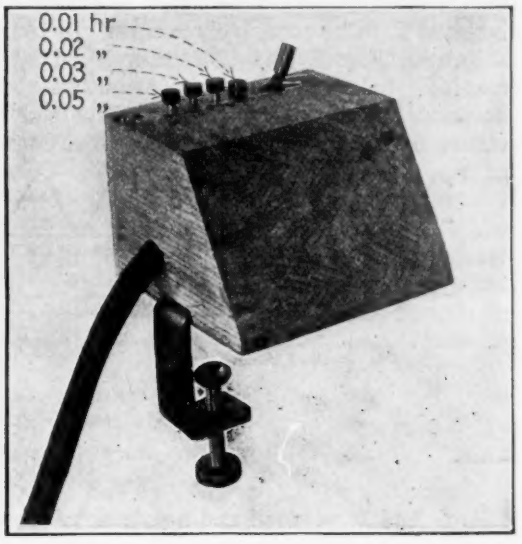
### Time Intervals in Use

The apparatus as completed and installed has been constructed to set off or operate at any of four different fixed time intervals as follows, 0.01 hour, 0.02 hour, 0.03 hour, 0.05 hour, which may be plugged by the operator on the remote-control block shown in Fig. 3. This provision has necessarily called for a more elaborate wiring scheme and for additional auxiliary equipment as discussed below.

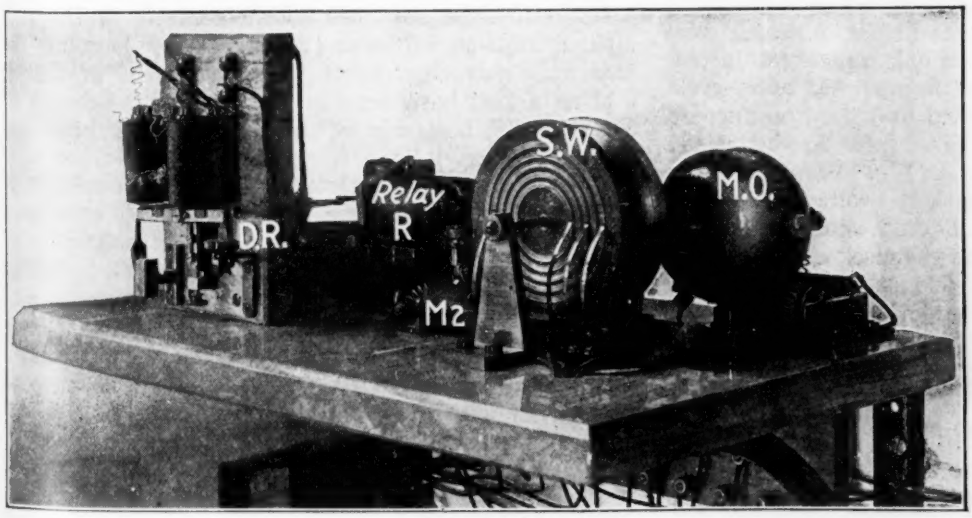
The completed installation with the exception of the clock is shown in Fig. 4, in which the various parts have been lettered to correspond to those in Fig. 1. It will be noted that the selective switch $SW$ is provided with additional slip rings and brushes to permit of the use of the additional time intervals mentioned above, which are obtained by properly spacing the contact segments on the edge of the disk.

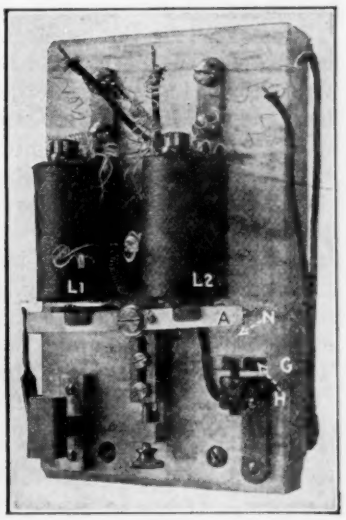
Since the ratchet wheel $R_a$ is provided with 100 teeth and hence 200 seconds are required for the plunger to cause it to make a complete revolution, considerable time would be lost if at the end of a test using the 0.01-hour (36-second) interval it would be necessary to allow the clock to return the selective switch disk to the starting point. To eliminate this loss of time, the selective-switch disk shaft is provided also with a friction-drive disk $F_d$ and a pivoted series-wound reset motor $M_o$ which is shown in Fig. 4. A notch or recess in the edge of the friction disk $F_d$ is set in line with the normal starting position of the finger $F_1$ on the disk $S_w$. When at the end of the test it is desired to reset the disk $S_w$ a depression of the proper key on the remote-control block (Fig. 4) causes current to flow to the motor $M_o$, which is also connected in series with a shifting magnet. This action causes the motor to be simultaneously started and turned about its pivot when its rubber-covered pulley engages the face of the disk $F_d$, driving this disk, its shaft and the disk $S_w$ until the starting point of $S_w$ is reached, where the motor pulley drives free in the notch or depression of $F_d$. Upon releasing the reset motor key of the control block (Fig. 3) a spring shifts the motor to its normal position of rest,




FIGS. 2 AND 3—CONTACT DEVICE IN USE WITH PENDULUM, AND PLUGGING BLOCK FOR FIXING TIME INTERVAL




FIGS. 4 AND 5—APPARATUS (EXCEPTING PENDULUM) MOUNTED ON TABLE, AND ENLARGED VIEW OF DIFFERENTIAL RELAY

where its pulley is out of contact with $F_d$ at all times.

The differential relay $D_r$ which takes the place of the snap switch and the operator's hand is shown best in Fig. 5. In the method here used the accuracy of the measurement is not, as in the case of the Boston Edison test-circuit system, dependent upon the rapidity and uniformity with which the ratchet wheel $R_a$ is stepped forward, but does depend upon the satisfactory operation of the relay $D_r$. While it is not important that the electrical and mechanical time lag of operation of relay $D_r$ be absolutely negligible, it is essential that the opening and closing operations be equal or nearly so if the time interval is to be accurately set off. In the construction shown in Fig. 5 this is accomplished by making the carefully balanced aluminum armature rod $A$ as light as possible, by giving this armature rod a very short stroke, by making the electrical time constants of the coils $L_1$ and $L_2$ as small and nearly equal as possible, and by using a compensating type of contact at $N$.

The contact at $N$ is of the steel-needle and mercury-cup type and is so adjusted that as nearly as possible the distance from the needle point to the mercury surface when the contact is open is equal to the distance from the needle point to the mercury surface when the contact is closed. With this adjustment accurately made the compensation is absolutely correct and no error is introduced into the measurement of the time intervals from this cause. That the needle adjustments need not be made with extreme accuracy to obtain good precision is illustrated by the oscillograms in Fig. 6, which were taken after the needle had been only roughly adjusted. The alternating wave in these figures was of 60-cycle frequency and was photographed only for the purpose of measuring time. The middle vibrator was connected into the clock-contact circuit at $a$ (Fig. 1) and the lower vibrator connected in series with the voltage circuit of the meter under test. The oscillogram shows a time lag of 0.025 second from the time the clock contact closes until the contact at $N$ (Fig. 1) closes. The oscillogram in Fig. 6b was taken with the middle vibrator in circuit at $b$ (Fig. 1) and shows a lag in the opening of contact $N$ of 0.031 second or an uncompensated difference of 0.006 second. With the shortest time interval used (0.01 hour) this amounts to an error of 0.017 per cent.

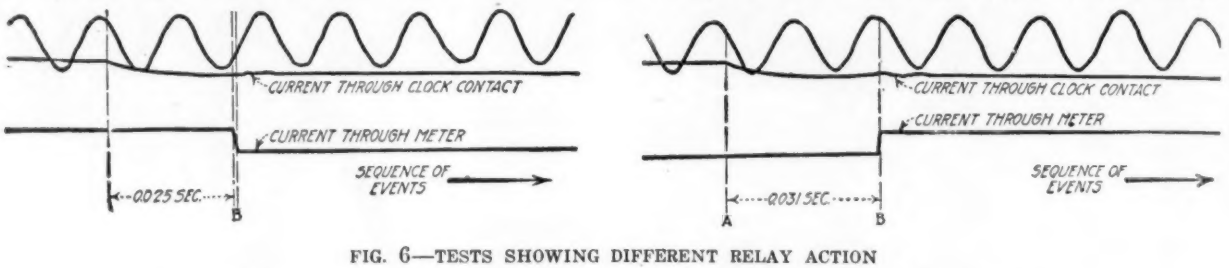



FIG. 6—TESTS SHOWING DIFFERENT RELAY ACTION

It is seen that (a) 0.025 second is required to close relay contact and (b) 0.031 second for opening. This difference is practically negligible.

## CONCLUSIONS

The fixed-interval timing device here described has been in continuous use in the standards laboratory of the University of Wisconsin since 1913, and through its use hundreds of portable standard watt-hour meters have been calibrated and readjusted. While several time intervals are available, it is seldom than any but the 0.01-hour (36-second) interval is used, since this interval gives ample accuracy and permits of greater speed in testing. It is estimated that with steady electrical conditions more accurate testing work is obtained with two 0.01-hour check runs with this apparatus than with six 90-second runs using the stop watch. From this the saving of time is at once apparent, particularly when it is remembered that none except mental calculations of the results are required.

The Seth Thomas pendulum clock with its magnetic contact was purchased from W. & L. E. Gurley of Troy, N. Y., and has been giving satisfactory performance, its change in rate seldom being greater than six seconds per day. The rest of the apparatus was built by the mechanician's department of the University of Wisconsin and could be duplicated at a nominal cost.

While the apparatus as constructed includes circuits for four time intervals, it might be much simplified through the use of a single time interval, which would be ample for most testing work in meter shops and laboratories. This would eliminate the need for the reset motor and its auxiliary circuits and would require but two slip rings and segments, as shown in Fig. 1.

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# PULVERIZED COAL AS A FUEL FOR HEATING BOILERS

## Summary of the Advantages of and the Limitations to the Use of This Combustible in Power Plants

Great interest has been shown recently in the possible utilization of lower-grade fuels by burning the coal in a pulverized form. The merits of pulverized coal as a fuel have been briefly stated by Edward R. Wells and W. H. Jacobi, of the J. G. White Engineering Corporation, as follows:*

1. If ground sufficiently fine, the entire combustible content of the coal can be burned, effecting economies hitherto not attainable even with the better coals.

2. It permits the use of all grades of coal, including peat and lignite, with an approximately equal degree of thermal efficiency for the same service.

3. It possesses very largely the facility of control and combustibility of oil and gas fuels, thereby placing coal on a parity with these fuels.

The limitations of pulverized coal are:

1. The high temperatures attending its efficient combustion and the unsteady mode of its deflagration, necessitating special furnace construction to secure reliable service and to realize the possible economies it affords.

2. The operating cost and attention required to maintain the necessary apparatus for its use.

3. The presence of ash, which may not always be collected and held under control.

4. The human element.

*See *Journal A. S. M. E.*, September, 1919, p. 744.

# California 220-Kv. Transmission Bus

## Proposal to Interconnect High-Tension Systems of That State, of Which a 220-Kv., 1100-Mile, 1,500,000-Kw. Line Shall Form the Backbone—Should Save Fuel Oil by Using Large Units and by Interchange of Energy

FUELS, particularly oil, must soon be used for isolated power only where hydroelectric power is not available, as in the propelling of air and ocean craft. In large power systems, especially in the West, the use must be limited to standby service, for peak loads, low-water periods and other emergencies California has available ample hydroelectric power to supply the industrial and agricultural demand for many years. But for purposes of economical operation these systems should be interconnected to permit practically unlimited exchange of energy. A proposal to interconnect the California transmission systems through a great bus extending nearly the length of the state is outlined in a paper by R. W. Sorensen, H. H. Cox and G. E. Armstrong, read at the Pacific Coast convention, A. I. E. E., on Sept. 20.

### Probable Load Demand in 1926

The best available information indicates a demand in 1926 approximately as shown below:

| | Kilowatts |
|---|---|
| 1. Sacramento Valley, northern portion | 70,000 |
| 2. Truckee River electrification | 40,000 |
| 3. Sacramento Valley, southern portion | 125,000 |
| 4. San Francisco Bay district | 250,000 |
| 5. Fresno district | 90,000 |
| 6. Bakersfield district, including Tehachapi electrification | 125,000 |
| 7. Los Angeles district | 300,000 |
| 8. Barstow and Needles district, including railroad electrification | 40,000 |
| Total | 1,040,000 |

In order to carry this load, approximately 500,000 kw. additional in hydroelectric capacity will be required.

A demand for power such as shown in the figures just given can be supplied most economically by power developed in large units, but large power units require transmission lines of the highest possible economic voltage.

It has been shown that for long transmission 220,000 volts is economical* under conditions which require a much more expensive construction than has proved adequate for the 150,000-volt lines of the Southern California Edison Company.

### California Transmission Bus

On this basis a plan as shown on the map is proposed. In this plan the interconnection of all the California power companies has been assumed as an economic necessity for its best utilization. Interconnections of limited capacity are not entirely satisfactory because they fail just at the time they are needed most to transfer from one system to another large blocks of power.

The plan of the proposed scheme involves the construction of a two-circuit transmission system extending from Pitt River to Los Angeles, a distance of 570 miles (920 km.). Branch lines of like voltage connect the three other power projects and the San Francisco load center to this main line, on which the other load centers are located. The main line thus becomes a high-tension bus extending nearly the entire length of the state, hence its name, "California Transmission Bus." This arrangement makes possible unlimited interconnection and exchange between all the power companies of the state.

Substations have been located at Marysville, Stockton, San Francisco, Fresno, Bakersfield and Los Angeles. These points are natural load centers and suitable points for connecting with the present power systems. On the Colorado River branch, the construction of which is dependent upon the electrification of the transcontinental railroads, substations would probably be located at Barstow and Needles. The substations divide the lines into sections of suitable length for practical operation, the longest section being 150 miles, as shown in the tabulation which follows:

1100-MILE BUS PROPOSED FOR UNIFYING THE CALIFORNIA SYSTEMS

| | Miles |
|---|---|
| Pitt River to Marysville | 15 |
| Feather River to Marysville | 60 |
| Marysville to Stockton | 90 |
| Stockton to San Francisco | 60 |
| Stockton to Fresno | 130 |
| Big Creek to Fresno | 40 |
| Fresno to Bakersfield | 100 |
| Bakersfield to Los Angeles | 100 |
| Bakersfield to Barstow | 110 |
| Barstow to Needles | 150 |

*Silver, "Problems of 220-Kv. Power Transmission," *A. I. E. E. Proceedings*, June, 1919, and abstracted in ELECTRICAL WORLD, June 28, 1919.

| | Miles |
|---|---|
| Needles to Colorado River | 100 |
| Colorado River to Phoenix | 100 |
| Pitt River to San Francisco | 300 |
| Big Creek to Los Angeles | 240 |
| Big Creek to San Francisco | 230 |

The standard frequency, 60 cycles, has been assumed on the basis that the Southern California power systems operating at 50 cycles will ultimately find it advantageous to conform to the A. I. E. E. standard. In the natural growth of the load 70 per cent of the 1926 load will be supplied by the 60-cycle systems. Interconnection of such large load centers or power sources through frequency changers limits the exchange of power, is uneconomical and increases tremendously the required operating vigilance.

### SUCCESSFUL OPERATION OF 150-KV. LINES

The practicability of the high-voltage line has been well demonstrated by over five years of remarkably successful operation of the 150,000-volt lines of the Southern California Edison Company, which during this period have delivered from the Big Creek power houses over the 240-mile (390-km.) lines to the Los Angeles distribution system 1,200,000,000 kw.-hr. at an average efficiency of 87.5 per cent with a 45 per cent load factor. During this period there have been no interruptions for which the high voltage is responsible; on the contrary, the system has been free from disturbances and interruption to a greater degree than the lower-voltage lines in the same locality.

The present Big Creek lines can be operated at 220,000 volts, 60 cycles, without material change. This is proposed as a link of the transmission bus, and its operation under these conditions will be analyzed and applied to conditions of the proposed system.

*Corona.*—As now operated, at 150,000 volts and 50 cycles, the voltage is only 80 per cent of the lowest critical voltage of any part of the line and there is no corona loss. At 220,000 volts, 60 cycles, corona loss occurs to some extent on the entire line but amounts to but 0.4 per cent of the line capacity during fair weather. With storm conditions over the entire line and with an assumed reduction of 20 per cent in the critical voltage, the corona loss would be 8 per cent of the line capacity. This loss is not sufficient to make the line inoperative and would occur too rarely to be an economic factor.

*Insulation.*—The Big Creek 150,000-volt lines have nine units in each suspension string and two eleven-unit strings in parallel on dead ends. During the five and one-half years of operation only two insulator string failures have occurred. Both of these were during normal conditions of operation without any apparent cause other than that of being in a location where the insulators have been found to have a relatively high rate of deterioration.

The Big Creek line towers allow sufficient clearance to permit the lengthening of the nine-unit suspension strings to eleven units, and to any desired number of units at dead ends. Safety factors for insulator strings, wet and dry, are given below:

| | Wet Arc-Over | | Dry Arc-Over | |
|---|---|---|---|---|
| | Nine-Unit String | Eleven-Unit String | Nine-Unit String | Eleven-Unit String |
| (87 kv. to ground) 150 kv. | 4.3 | ... | 4.8 | ... |
| (127 kv. to ground) 220 kv. | ... | 3.7 | 3.3 | 3.4 |

The Big Creek line, operated at 220,000 volts, is at the critical corona voltage, and any disturbances resulting in a higher voltage will quickly expend their energy in producing corona loss, which will permit a smaller safety factor to be used.

Curves showing arc-over voltage in Mr. Silver's paper show no practical gain in dry arc-over voltage for strings of more than ten units, and with these facts in view it is proposed that for operating the Big Creek line at 220,000 volts suspension strings have eleven units and dead-end strings twelve units in series. Insulator testing crews have several times reported four and five defective units in a nine-unit suspension string, without any indication of trouble. The only apparent value of a longer string than that proposed would be a decreased probability of sufficient defective units in a string to cause breakdown. Developments of methods of grading insulator units and shielding insulator strings will, in all probability, materially change the number of insulators required.

Present-day methods of insulator testing and maintenance would probably have prevented the two failures which have occurred on the Big Creek lines as previously mentioned. These methods applied to the lines operating at 220,000 volts, and the use of the better types of insulators now available will insure successful operation.

*Charging Current.*—Long high-voltage lines cannot be operated without synchronous condensers at the receiving station to regulate the voltage, and as a consequence the charging current, even at the standard 60-cycle frequency, becomes a factor of no great importance as long as these synchronous condensers are connected to the line.

Without these condensers the line-charging current must be furnished entirely by the generators, in which case the generators may become greatly overloaded and at the same time produce a very high voltage over which the operator has no control. To avoid this emergency a transmission line, with its generators, transformers and synchronous condenser, must be considered as a unit and as such should be securely coupled together electrically at all times. This has been proved practicable in the case of the Big Creek system, in which it is possible to start the 15,000-kva. condensers and bring them up to speed with the generators.

*Line Capacity.*—The Big Creek lines as operated at 150,000 volts with 30,000 kva. condenser capacity per line at the receiver end are each good for 57,500 kw. at 85 per cent power factor and will have under these conditions a line drop of 11 per cent. Operated at 220,000 volts, these lines should each have a capacity of 125,000 kw. with an equal line drop when provided with the proper condenser capacity, which is approximately 75 per cent of the line capacity in kilowatts.

This is a fair indication of the conditions which will exist in the proposed system, the load centers of which are so distributed as to limit the actual average distance of transmission to about 200 miles (320 km.). The economic gain in doubling the capacity of lines, which cost approximately $6,000,000, the present cost of which would be at least 30 per cent more, would more than offset the cost of all necessary changes, including the adoption of the standard frequency.

*Mechanical.*—The type of constructions used on the Big Creek line has proved entirely adequate for California conditions. There have been only three mechanical failures, all of which occurred shortly after the line went into service and were due to defective line

hardware. In one case the failure was due to faulty design. There have been no tower failures, and no tower maintenance whatever has been required. Approximately 20 per cent of the Big Creek line is subject to ice and snow conditions, parts of it reaching altitudes of 5000 ft. (1500 m.). Similar conditions exist over practically the entire proposed 220,000-volt system.

*Operation.*—The most interesting feature of the operation of the Big Creek system is its reliability, which has been equal to that of steam plants of similar capacity built near load centers. Flashovers have caused only momentary interruptions and have in no case resulted in damage such as to prevent immediate resumption of service. During the greater part of the time the power has been carried over a single line for a large part of the distance.

COMPARATIVE DATA ON CALIFORNIA TRANSMISSION BUS

| | Big Creek Lines at 150 Kv. | 220-Kv. Lines as Proposed by Silver |
|---|---|---|
| Aluminum steel cable: | | |
| Diameter | 0.95 in. | 1.036 in. |
| Circular mils | 683,000 | 808,900 |
| Weight per foot | 0.75 lb. | 0.94 lb. |
| Length of average span | 750 ft. | 800 ft. |
| Weight of towers without footings: | | |
| Suspension | 4,300 lb. | 9,000 to 14,000 lb. |
| Anchor | 6,450 lb. | 24,000 lb. |
| Stringing tension at 80 deg. F.: | | |
| No ice allowance | 4,740 lb. | |
| Ice allowance | 3,130 lb. | |
| Maximum tension allowed | 8,500 lb. | 17,300 lb. |
| Insulator strings to carry load: | | |
| Suspension | 1 | 2 and 3 |
| Anchor | 2 | 6 |

High-tension line switching and synchronizing have been carried on consistently throughout the operation of the Big Creek system without trouble and should be possible on the 220,000-volt system. During times of switching, slight discharges, never followed by an energy current, occur on the arresters. Operating at corona voltage rather than at 80 per cent of the critical voltage, it may be possible to absorb these disturbances without arresters.

Complete parallel operation of all lines must be adhered to in the proposed system. Satisfactory protective relay systems for dropping defective sections with little disturbance have been developed for present parallel transmission lines, and there appear to be no obstacles to extending these to the higher voltages.

*Generators.*—Curves may be worked out to show the voltage to which an unexcited alternator will rise when connected to condensive loads, *i.e.*, unloaded transmission lines. Such curves worked out for various sizes of generators and 220-kv. lines show that this system may be operated without losing control of the voltage. The curves were verified by actual tests on the 17,500-kva. generators at Big Creek. This investigation showed that generators for such a system should be designed with the highest short-circuit ratio that other conditions will permit.

*Conclusions.*—Such a system as proposed is needed immediately. All engineering fundamentals essential to a solution of its problems are well understood and the Big Creek system can be used as a part of the project without material reconstruction.

To supply this need arrangements should be made without delay for a complete working out of all details of the proposed system.

## COMPARISON OF DRIVES FOR ROLLING-MILL TABLES

### Factors Affecting Cost and Reliability of Service with Both Alternating-Current and Direct-Current Motors Are Alalyzed

IN ORDER that the cost of making a ton of steel may be minimized, the adoption of alternating-current motors for rolling-mill table drives will have to be given more consideration according to a paper presented by W. S. Hall, electrical engineer of the Illinois Steel Company, South Works, Chicago, before the Association of Iron and Steel Electrical Engineers at St. Louis this week. As a basis of comparison of the two types of motors, Mr. Hall analyzed and compared a few typical motor drives as to the size of motor required and the cost of installation. The first installation to be considered was what is known as the front roughing table in a continuous light-rail mill while rolling a 60-lb. (27-kg.) rail. A duty-cycle curve taken with a curve-drawing ammeter showed each pass to be between three seconds and four seconds duration with the power off the motor during the cycle for no longer than periods of one and one-half seconds. It also showed that the load was one of acceleration entirely as the motor does not attain free-running speed at any time.

The horsepower computed from this curve by the root-mean-square method figures out approximately 28.5 hp. for a time consisting of four typical operating cycles, and to be safe the motor was selected with the assumption that the mill operates on this cycle for a period of three hours. This required a 40-hp. motor rated on the one-hour basis. The corresponding alternating-current motor would be one which would deliver 45 hp. at its one-hour mill rating. As a further check the maximum torque required was found to be 1225 ft.-lb. (16 kg.-m.), while the maximum alternating-current torque available from the selected alternating-current motor would be 1280 ft.-lb. (177 kg.-m.).

Assuming the cost of installation of the direct-current motor to be 100 per cent, the cost of installing the alternating-current motor will be approximately 132 per cent, divided as follows in each case:

| Direct-Current Installation | Per Cent | Alternating-Current Installation | Per Cent |
|---|---|---|---|
| Motor | 49 | Motor | 69 |
| Control | 30 | Control | 40 |
| Wiring material | 13 | Wiring material | 13 |
| Labor | 8 | Labor | 10 |
| Total | 100 | Total | 132 |

It will be noticed from this that the increased cost is due largely to the cost of the motor and controller, the installation labor and material running about the same in either case, assuming that a 220-volt alternating-current motor is adopted. In each case the control is assumed to be magnetic.

The next case to be considered was what is known as the back-roughing table in the same mill. Carrying the calculation through in the same manner as in the first case, the cost of one compared with the other will be approximately as follows:

| Direct-Current Installation | Per Cent | Alternating-Current Installation | Per Cent |
|---|---|---|---|
| Motor | 50 | Motor | 75 |
| Control | 30 | Control | 35 |
| Wiring material | 13 | Wiring material | 13 |
| Labor | 7 | Labor | 8 |
| Total | 100 | Total | 131 |

The increased cost as before is due almost entirely to the cost of motor and controller.

Another drive to be analyzed is the roughing table in a sheet-bar mill. This cycle involves one pass and severe plugging to bring the table to rest. The duration of the pass is from two and one-half seconds to three seconds with a twenty-second rest period. The drive, as figured out by the root-mean-square method, is 51 hp. and on a three-hour basis would demand an 80-hp., one-hour mill-rated motor. Assuming that the standard 75-hp., one-hour mill-rated alternating-current motor would handle the work satisfactorily, the comparative cost would be as follows:

| Direct-Current Installation | Per Cent | Alternating-Current Installation | Per Cent |
|---|---|---|---|
| Motor | 56 | Motor | 60 |
| Control | 29 | Control | 32 |
| Wiring material | 11 | Wiring material | 9 |
| Labor | 4 | Labor | 4 |
| Total | 100 | Total | 105 |

In this case the difference in first cost is not very great as the two motors selected correspond almost exactly in size and price.

The last drive to be considered is the front mill table in a 132-in. (335-cm.) plate mill. The duty is severe and the periods are all of short acceleration. The table is subjected to severe plugging as the piece being worked must be in the rolls as much of the time as possible in order to maintain a high tonnage output. The total required horsepower as read from the curve, is between 38 hp. and 39 hp. On a three-hour basis a 50-hp., one-hour mill-rated motor would be required, but, on account of the severe service conditions, a 75-hp. alternating-current motor would be more satisfactory, as the margin of safety in this class of work should be large to insure continuity of service. A 75-hp. alternating-current motor of this type will develop a maximum starting torque of 1540 ft.-lb. (212 kg.-m.), while the maximum torque required as shown by the curve with the direct-current motor operating is 1500 ft.-lb. (207 kg.-m.). The comparative cost under these conditions will be as follows:

| Direct-Current Installation | Per Cent | Alternating-Current Installation | Per Cent |
|---|---|---|---|
| Motor | 60 | Motor | 75 |
| Control | 28 | Control | 42 |
| Wiring material | 8 | Wiring material | 13 |
| Labor | 4 | Labor | 6 |
| Total | 100 | Total | 136 |

From these analyses it can be seen that the increased first cost of the alternating-current installations would be above 20 per cent for the complete mill, varying, of course, to a marked degree with the number of drives and the nature of the work for which the mill is designed. If the mill contains a large number of drives which are subjected to severe plugging and rapid acceleration, the increased cost, no doubt, will be considerably more than 20 per cent.

The drives upon which engineers are reluctant to adopt the alternating-current motor are primarily the tables on either side of the mill proper. This is because they are subjected to rapid acceleration and severe plugging. While drives of this type do not, as a rule, represent more than 15 per cent of the total installed motor horsepower, they may represent as high as 60 per cent of the total load on the converting apparatus and mill feeders, and therefore to equip these drives with direct-current motors and the remainder with alternating-current motors is likely to bring a very slight gain in operating economy, making it necessary to consider other factors than those pertaining to the relative operating characteristics of the two types.

Assuming that sufficient converting capacity is available at a distance of, say, 2000 ft. (600 m.) and the cost of this 2000 ft. of line is taken at 100 per cent, the cost of an alternating-current, 6600-volt line and the necessary transformers would be approximately 145 per cent of the cost of the direct-current transmission line. This difference in first cost must be offset by the increased operating economy obtained by the use of the alternating-current system. Of course, this difference in cost of operating the two systems can be readily arrived at if the mill operates continuously. However, this is likely not to be the case, with the result that the alternating-current investment charge goes on continuously while the operating economy made possible by this investment charge can be realized only during periods of actual operation. If, however, converting capacity for direct-current motor operation is not available, the cost of installing the necessary transmission line and converting apparatus will probably run over 200 per cent of the cost of the alternating-current transmission line and transformers, representing a case where the first cost and operating economy are both in favor of the alternating-current motor installation. If the proposed new mill is being erected adjacent to a direct-current mill already operating, the converting apparatus could readily be used to help out the other in an emergency, giving a flexibility of operation which could not be obtained with one mill operating on direct current and the other on alternating current. The investment represented by spare motor parts and control equipment is considerable in a number of cases.

If sufficient converting capacity is available to take care of the more severe operations, the remaining drives can without doubt be handled more economically and just as satisfactorily with alternating-current motors. If additional converting capacity is to be installed and the required capacity would warrant the purchase of converting apparatus, duplicate of that already in service, which could be handled with no additional operating expense, such as labor etc.—which machine could then be available for other service—it might still be advisable to install direct-current motors not only on the harder work drives but also throughout the entire mill, even though the apparent economy is less. It therefore appears unwise to take a definite stand in favor of either type of motor. Local conditions must govern almost entirely.

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I ADVISE the people of this country that they can make no better investment than one liberal enough to cause the teaching profession to attract not only those whose high sense of duty leads them to embrace it as a sacrifice, but also those who cannot afford to make the sacrifice, however anxious they may be to do so. Men preparing for research must have the best men in the country to guide them, and it is not fair to expect these men, as so many have done in the past, to live the narrowing life of poverty. Neither is it wise.—*Dr. William H. Nichols, president American Chemical Society.*

# Remote Control for Theater Lighting

## Flexibility, Speed, Noiselessness, Lower Cost, Less Space and Safety Are Combined in a Rebuilt Installation at Chicago—Switches for Any Scene Set in Advance and Operated by Master Switch

IT SEEMS probable that more theater installations will be made during the next few years than have been made in a similar period in the past. Among the causes for this are the recent activities in building and the effect of the national dry law. For this reason it seems important at the present time to set down some

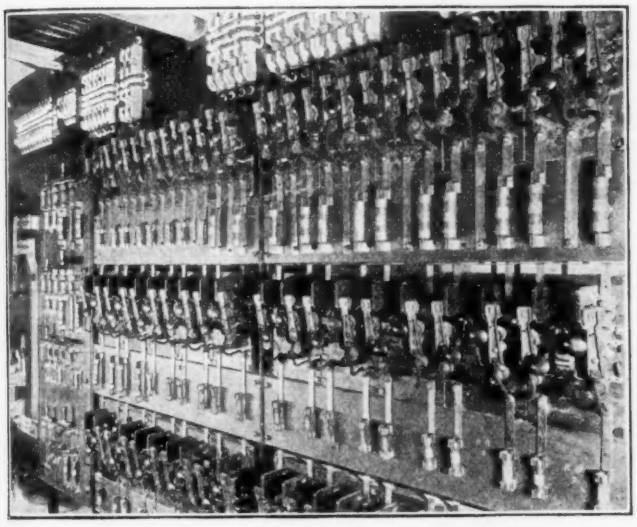


FIG. 1—REMOTE-CONTROL CONTACTOR BOARD

of the available technical information about better electrical practice for theaters. Even men in the electrical industry hardly realize what advances are being made in the theater lighting, wiring and control practice. Especially in the wiring and control features requirements have become particularly exacting. This is partly due to the lavish use of electricity in quantities so great that the lighting load of a single theater for some productions equals the lighting load for a small town. It is also due in a measure to the varying and exacting demands of individuals and groups interested in the purchase, installation or operation of the equipment.

For instance, the producer has insisted that electrical control be instantaneous, that it be highly flexible, that it be unfailingly dependable. The municipal authorities have declared that the installation shall in no way jeopardize the safety of the public. The theater owner has argued that the cost of the installation shall be reasonable and that it shall give results. The stage manager has desired that the control apparatus shall not occupy space that should be available for scenery, properties and actors.

To reconcile these conflicting interests has of itself been an arduous task for the electrical designer. Frequently it has been so difficult of solution that recognition of the fact that a stage electrician has only one pair of hands was, or possibly had to be, left out of the problem. Considering the fact that a modern stage switchboard has from forty to sixty switches and almost as many dimmers, no great imagination is required to picture the results. There is, in fact, one large theater in Chicago where during a recent performance the stage electrician had to lash the switches in the various rows to broom handles, two of which he pulled with his hands while he managed to open the remaining switches with his arms, these groups being tied to them by pieces of rope.

Quite different, however, is the recently completed electrical installation in the Illinois Theater, Chicago. It is thought to be the last word in theater-lighting control. It meets all the requirements of the theater owner, the stage manager, the city inspection department and the stage electrician. Any combination of switching desired by a stage manager can be obtained by the stage electrician with the pressure of a single finger. In general, the installation consists of a control board or "pilot" board on the stage and a remote-control contactor board and metering board in the basement. A feature of the pilot board is its unit construction. Each separate switch is a standard unit. The parts of all switches are mounted on the steel-frame inclosure or tub and are interchangeable with those of

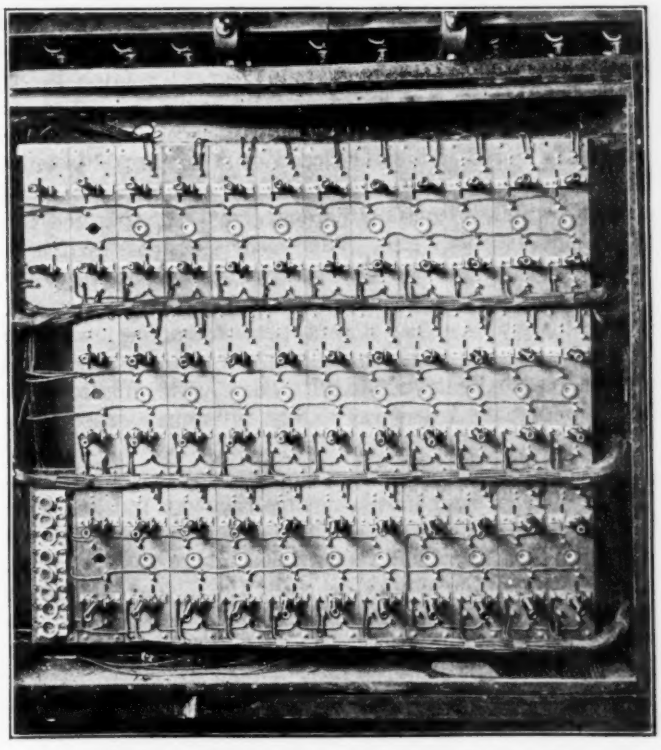


FIG. 2—FRONT VIEW OF PILOT SWITCHBOARD, SHOWING SLATE SWITCH PANELS

any other unit regardless of its function. Each switch can be removed from the board without interfering with any other switch. The moving parts of these switches are plain copper strips of generous proportions, terminating in a handle projecting through the steel inclosing cover. The contacts are of the laminated wiping type, of rugged construction. Access to these contacts for repair in case it should be needed, or for connecting control and pilot wires, can be had from the front without disturbing any connections.

All live parts, wires and connections are inclosed in a steel cabinet, making the installation absolutely "dead-front" and fool-proof as well. As only No. 14 control and pilot wires need be run to this pilot board, instead of heavy circuits and feeders as with the old type of stage boards, the cost of this type of installation is no more and in many cases is less than that of the old type. The saving in stage space is at least 75 per cent on most jobs of this kind. In the Illinois Theater the new pilot board occupies less than one-fourth the space taken up by the old switchboard.

On this job the underground service enters the basement under the stage, coming into a fireproof room large enough to accommodate the service and distribution boards with ample space all around each. The service cables connect to the 2000-amp. service switch on the panel at the extreme left in Fig. 1, on which also are mounted the recording kilowatt-hour meter, printometer, etc., required by the Commonwealth Edison Company. Adjoining and to the right of the service panel is a feeder panel to control circuits that are not required to be controlled from the stage, such as emergency lights, front-of-house lights, dressing-room lights, motor circuits, etc.

To the right of this is an angle-iron structure carrying thirty 100-amp. contactors in three rows of ten each. One in each row is a spare. These are all operated by means of the pilot board on the stage. These remote-control contactors are of the mechanically latched type, having two coils, one for closing the switch and the other for opening. Each switch is operated by two normally open pilot switches. Making contact on one energizes the closing coil. When the switch is closed it is held closed by a latch. This latch is released by pressing the opening handle on the pilot switch, which momentarily energizes the opening coil and releases the latch. This remote-control switch is simple in construction and positive in operation.

Busbars on rear of board are used for all connections, doing away with wire. Connections from the lower two rows of switches to the terminal board at the top of the switchboard are also made with bars. The smallest busbar copper used will carry safely 100-amp., irrespective of load. This insures rigidity.

Above the switchboard along its entire length is a header box to act as an inclosing raceway for the various wires. On the front of this header box are mounted cut-out blocks for such circuits as stage pockets, etc., each group of cut-outs being mounted just above its respective control switch. While the stage pockets are controlled from the stage, only a few control and pilot No. 14 wires are run for this instead of the respective feeders. This type of construction makes a large saving in cost.

These small control wires are run from their respective switches into the header box in small steel troughs provided for the purpose on the rear of structure. From the header box the various wires are carried in conduit to their respective destinations.

The pilot board is shown in detail in Figs. 2 and 3. The three switches in lower right corner are for the feeders serving the groups of auditorium lights, with a master switch immediately adjoining on the left. Then there are six switches for all blue lights; that is, four blue border circuits, the blue footlight circuit and the blue proscenium strip circuit, with a master switch for all blue-light circuits at the left. It will be noticed that master switches have no pilot light, like the others. That is the only difference between them. The blank panel at the lower left corner is a door giving access to four two-wire plug cut-outs. Three of these are used to fuse the three-color control circuits, there being one circuit for each tier of remote-control contactors on switchboard. The closing coils of the contactors take 0.7 amp. each and the opening coils 0.4 amp. each. The fourth cut-out is for the master control circuit.

The four switches on the right end of the middle row control four groups of stage pockets, while the next six control all of the circuits supplying red light for the borders, foot and proscenium strips, with a master switch for all red lights adjoining. Then follows a blank space containing seven push-button switches for controlling work lights, rigging-loft lights, fly-gallery lights, etc.

The top row is a repetition of the middle row except

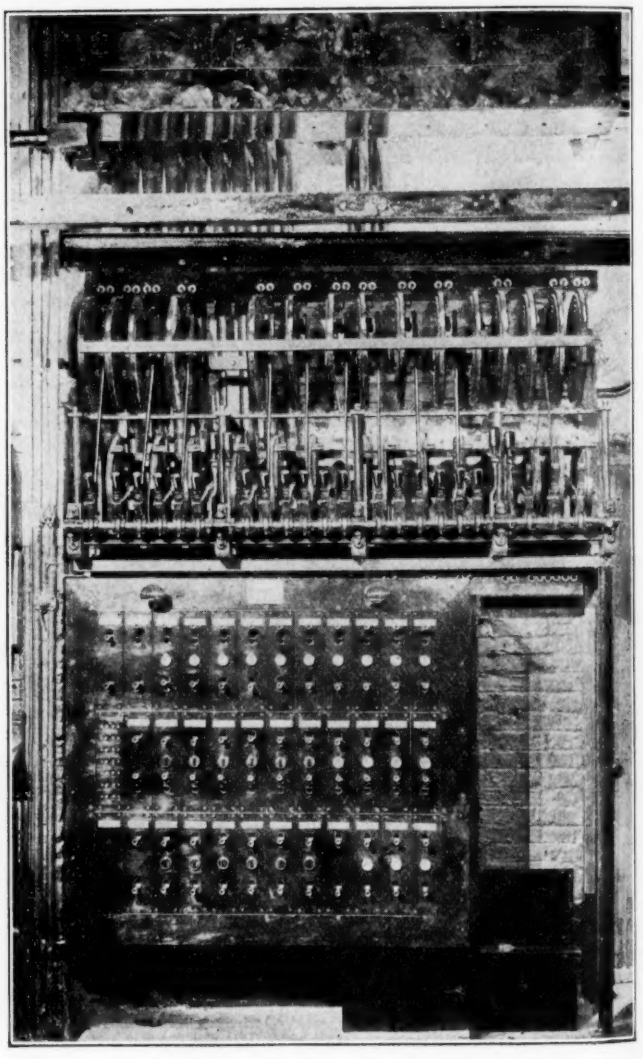


FIG. 3—A COMPLETED INSTALLATION, SHOWING PILOT-BOARD DIMMERS AND FUSE MAGAZINE

that the respective switches control the white lights in foot borders and proscenium, with a master switch for all white lights. In the extreme upper-left-hand corner of the board is a grand master switch controlling all other switches. At the top, mounted in the mat, are two receptacles with green half-shades for lighting the board.

Fig. 2 is a view of the pilot board with the face plates

and mat removed, showing the manner in which the control wires are taken out to the raceway at the top, bottom and sides of steel inclosing case, covered by the mat. The back of the inclosing case, or tub, serves as a pull box for various wires that pass up behind it to the dimmers just above and to the fuse magazine above the dimmers.

Fig. 3 shows this relation between the pilot board, dimmers and fuse magazine. The fuse magazine consists of a steel cabinet with four steel doors with vault handles. It is accessible from a platform built between the dimmers and the magazine which is reached by an iron ladder. The dimmers are mounted so that any dimmer can be removed without disturbing other plates. A steel plate reaching from the fuse magazine platform to the dimmer lever shaft, but which was removed to show the dimmer arrangement, incloses the entire dimmer bank. The dimmer plates are in two rows, but the operating levers are all in one row. The fuse magazine contains the cut-outs for the footlight circuits, border-light circuits and auditorium branch circuits. It should be said, in passing, that Fig. 3 is reproduced from a photograph before the work was entirely completed, so that several temporary connections showing in the picture have since been removed. By use of a header box above and running along the entire length of the dimmer bank exposed or loose wires are eliminated.

### Ingenious Design of Control Switch

In the operation of the pilot board the real value of this installation is shown. Each pilot-switch unit has two handles, the upper one being the "on" handle, the lower one the "off" handle. Each of the two handles can be moved either up or down. The downward movement closes the operating circuit only momentarily; that is, only as long as the handle is depressed. This operates the remote-control contactor. The upward movement of either handle sets the pilot switch permanently into the ready-to-operate position, as will now be explained. This (upper) position of the pilot switch handle produces no effect on the respective remote-control contactor until the master pilot-switch lever is operated into the down or momentary position. The grand master pilot-switch unit stands in the same relation to the sub-master or color-master switches that the latter occupy to the units of their respective color or group. By this arrangement it is a simple matter to get instantaneously any combination of lighting circuits on or off, singly or in whatever grouping is desired. Thus while a scene is being played a set-up of the grouping wanted for the following scene (or several of them) can be made ready to come on at the cue by pressure of one master handle without affecting the lights that are operating. There is no opportunity for uncertainty or confusion. A glance at the position of any operating handle shows the condition of the respective pilot-switch. The pilot lamp mounted between the upper and lower operating handles definitely shows the condition of the circuit controlled by that switch.

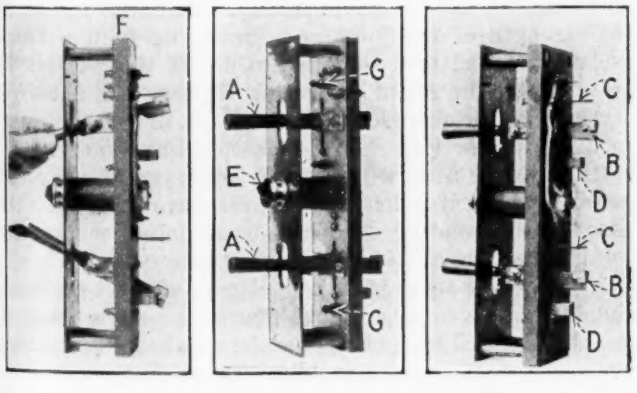



FIG. 4—PILOT-SWITCH UNIT FOR REMOTE CONTROL OF LIGHTING CIRCUITS

Installed in a fireproof room in the basement and operated from the pilot board on the stage.

Unit switch assembled with panel in front to show relation of following important elements: A, operating handles; B, switch blades; C, momentary contacts; D, retaining contacts for setting switches later to be operated by master switch; E, pilot lamp; F, slate base; G, steel inclosing front. The use of this pilot switch adds to the flexibility of control, so essential in making quick changes in the lighting effect. A pilot switch operates the closing coil of remote-control contactor. When the upper switch, for example, is brought down the upper momentary contact is made which closes the circuit to the closing coil and thereby closes the remote-control contact switch. When the handle is released the knife switch immediately returns to the neutral position. The switches are operated in this manner whenever an individual circuit is to be handled. A number of circuits may be operated simultaneously by the master switch if their pilot-switch handles are set up.

G. M., grand master switch; W. M., white master switch; W. F., white footlight switch; W. B. No. 1, white border-light circuit No. 1; O. C., opening coil of contactor; C. C., closing coil of contactor; R. M., red master switch.

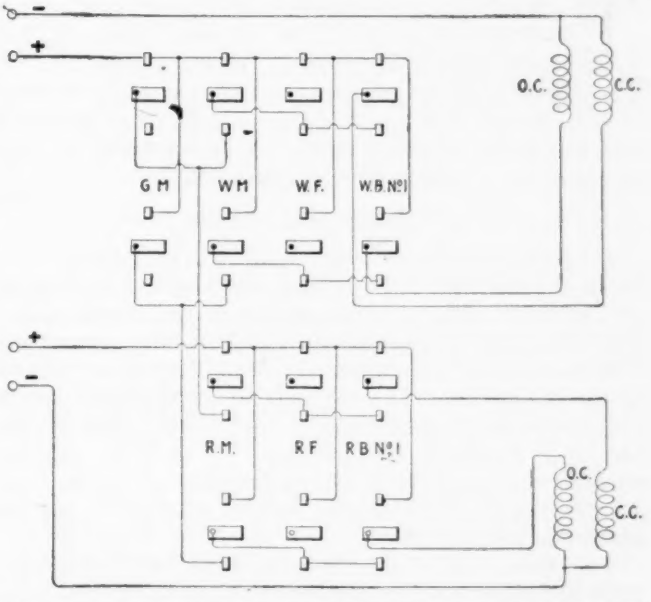



FIG. 5—WIRING DIAGRAM SHOWING REMOTE-CONTROL SCHEME

### A Convincing Demonstration

To appreciate the value of this pre-setting arrangement to those in charge of theatrical electrical work one has only to visit the stage of the Illinois Theater during a fairly pretentious performance and then to visit a theater with old-fashioned control during a production of similar character and quality. Such a visit shows clearly the great difference in the base of control between the old plan and the new.

The installation of this equipment was handled by Albert Uhl, of the Henry Newgard Company, in cooperation with Marshall & Fox, architects. The unit-switch idea, the remote-control features and the wiring system were developed and are manufactured by R. E. Major, 2352 Wilson Avenue, Chicago. On the Illinois Theater installation all switches and contactors are operated by direct current; but in another and similar job at the People's Theater the entire layout operates on alternating current. Cutler-Hammer contactors of 100-amp. rating are used on both jobs.

# Training Arc Welders—II

## Concise Course Intended to Familiarize Welders with Basic Characteristics and Operation of Bare Metallic Electrode Arc-Welding Processes—Exercises Are Outlined Which Aid Apprentice in Overcoming Difficulties in Manipulation

BY O. H. ESCHHOLZ
Research Engineer, Westinghouse Electric & Manufacturing Company

THE selection and preliminary instruction of arc welders was taken up in the first article of this series in the ELECTRICAL WORLD, Sept. 27. A discussion of the principles necessary for the production of satisfactory welds was also begun which is amplified and concluded in this number. Welding terms are defined and a bibliography is appended.

### WELDING PROCEDURE

*Preparation.*—Satisfactory welds will be obtained only when the sections to be welded are properly scarfed or cut out and the surfaces on which the deposits are formed cleaned before and during the welding operation. The scarfs may be machined or cut with a cold chisel or the carbon arc. The surfaces of the deposited layers may be cleaned with a chisel or wire brush, although the use of a sandblast is preferable. The joint sections should be separated by a free distance of about $\frac{1}{8}$ in. (3 mm.) in order that the bottom of the V may be accessible to the welder.

The scarf angle and free distance vary inversely. Both are determined by the depth of the V. If the character of the work is such that it is not practicable to separate the joint sections, the V should be cut at the bottom to form a 90-deg. angle, this angle being reduced to 60 deg. as the surface is approached; otherwise the scarf angle may be reduced along the entire length to 60 deg., excepting in the case of very deep welds. It is usual practice now to scarf plate welds to 60 deg. and separate the sections $\frac{1}{8}$ in. for V's up to $\frac{1}{2}$ in. (13 mm.) in depth.

Fig. 19 illustrates the poor fusion obtained at the bottom of the V on welding a 1-in. (2.5-cm.) square bar, scarfed 60 deg., without the use of a free distance. Fig. 20 illustrates the satisfactory union obtained with the use of free distance of $\frac{1}{8}$ in. Whenever a butt joint is accessible to horizontal welding from both sides, it is preferable to scarf the sections to a double-bevel, double-V joint.

*Choice of Arc Current.*—This is determined by the thermal conductivity and capacity of the joint as previously discussed, a convenient criterion being the depth of arc crater. The arc current selected should be of such a value that on welding the given sections the depth of the arc crater or "bite" is never less than $\frac{1}{16}$ in. (1.6 mm.).

*Selection of Electrode Wire.*—The following is an abstract of the bare electrode specification prepared by the welding committee of the Emergency Fleet Corporation:

Chemical Composition:

| Per Cent (Maximum) | | Per Cent (Maximum) | |
|---|---|---|---|
| Carbon | 0.18 | Sulphur | 0.05 |
| Manganese | 0.55 | Silicon | 0.08 |
| Phosphorus | 0.05 | | |

Physical Properties: Wire to be of uniform homogeneous structure, free from oxides, pipes, seams, etc.

Finish: The surface shall be free from rust, oil or grease.

Operation: Electrode material shall flow smoothly in relatively small particles through the arc.

*Electrode Current Density.*—To maintain a uniform flow of the metal, neither too slow, which causes excessive penetration, nor too fast, which produces excessive overlap, an electrode diameter should be chosen such that the current density is approximately 8000 amp. per square inch (1240 amp. per sq. cm.). For the usual sizes of bare wire available this corresponds to the following welding currents:

| Arc Current (Amp.) | | | Electrode |
|---|---|---|---|
| Normal | Maximum | Minimum | Diameter (In.) |
| 225 | 275 | 190 | $\frac{3}{16}$ |
| 155 | 190 | 125 | $\frac{5}{32}$ |
| 100 | 125 | 70 | $\frac{1}{8}$ |
| 60 | 70 | 45 | $\frac{3}{32}$ |

If covered electrodes are used, the direct-current rating for the wires should be decreased roughly to 60 per cent of these values. If bare wires are used on alternating current, the rating should be increased from 20 per cent to 40 per cent.

*Procedure.*—The first layer should thoroughly fuse the apex of the V. Wherever possible inspect the reverse side, as the deposited metal should appear projecting through. Subsequent layers should be fused then to the preceding layers or to the scarfed face. The final surface should be from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. (1.6 mm. to 3 mm.) above that of the adjacent sections. This welt increases the strength of the joint or permits the joint surface to be machined to a smooth finish. If the weld is to be oil-tight, the metal projecting through the abutting sections on the reverse side as a result of the first step in filling the section should be chipped out and the resulting groove filled with at least one layer of deposited metal. This extension of the procedure is frequently used in the welding of double-bevel joints where the joint is to have a "100 per cent" strength.

If a vertical seam is to be welded, sufficient material should first be deposited to produce a shoulder so that the added metal may be applied on an almost horizontal surface to facilitate the welding operation.

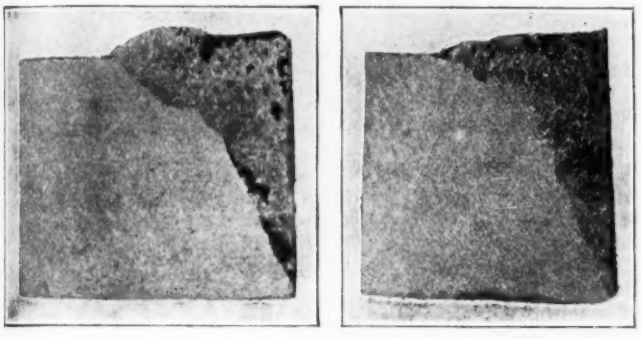
If an overhead seam is to be welded, the operation is simplified by placing on the upper side of the joint a heavy steel plate covering the apex of the V. A shoulder is then formed by an initial deposit of metal, the operator continuing to add metal to the corner so produced and the vertical face of the shoulder.

The considerations pointed out under the section on thermal characteristics determine whether it is necessary to preheat and anneal the joint. The method used in filling the scarfed section is determined by the preference for either the rigid or non-rigid system.

When using the rigid system both sections of the joint are firmly clamped to prevent either member from moving under the stresses produced by the expansion and contraction obtained during the welding operation. If

a proper welding sequence is not followed, the accumulation of "locked-in" stresses on cooling may be sufficient to rupture the welded area. To minimize these stresses it is the usual practice to tack the plates together at the apex of the scarf with short deposits at about 1-ft. (30-cm.) intervals, and then to deposit single layers in alternate gaps, each tier being completed before adding a second tier at any section. This procedure tends to maintain a low average temperature of the joint and plate, thereby decreasing the amount of expansion, while the deposition of the metal in layers serves partially to anneal the metal beneath and materially reduce "locked-in" stresses.

In the non-rigid system both members of the joint are free to move. To prevent the edges of the plate from overlapping or touching as shown in Fig. 18, the initial free distance is made great enough to equalize



FIGS. 19 AND 20—WELDS SHOWING POOR AND GOOD FUSION

Section through one-half of a welded joint showing poor fusion obtained at apex of V as the result of assembling the joint sections without a "free distance." Section through one-half of a welded joint showing excellent fusion obtained as a result of the use of a "free distance" of $\frac{1}{8}$ in., thus permitting the operator to maintain a short arc when welding the bottom of the V. Failures of deep welds may be usually attributed to the use of too small a "free distance," low welding current, improper cleaning of scarf faces or incomplete slag flotation.

the movement of the plates caused by the contraction of the hot deposited metal. On welding long seams of $\frac{1}{2}$-in. (13-mm.) plate the contraction is limited by maintaining a spacing block $\frac{5}{16}$ in. (2 mm.) wide, approximately 1 ft. ahead of the welded section. With a "free distance" of $\frac{1}{8}$ in. (3 mm.) the contraction stresses draw the plates together a distance of $\frac{3}{16}$ in. (4.8 mm.). This modification converts the non-rigid into a semi-rigid system.

## INSPECTION

No direct, non-destructive means are available for readily determining the strength and ductility of welds. A number of indirect methods, however, are in commercial use which give a fair measure of weld characteristics if intelligently applied. They consist in estimating the degree of fusion and porosity present by critically inspecting the surface of each layer and in noting the depth of liquid penetration through the completed section.

In examining each layer the amount of oxide present, smoothness and regularity of the surface, its contour, freedom from porosity and depth of crater should be noted. After a little experience these observations will give the inspector a good indication of the manipulative ability of the welder and of the degree of fusion obtained, as discussed above.

A succession of unfused zones will produce a leaky joint. These sections may be detected by flooding one surface of the joint with kerosene, using a retaining wall of putty, if necessary, as the liquid penetrates through the linked areas and emerges to stain the opposite side.

## BRIEF TERMINOLOGY

The following terms are used most frequently in arc welding (for a complete nomenclature of welds and operations the instructor is referred to the bibliography):

*Free distance*—The amount that the joint sections are separated before welding.

*Overlap*—The area of deposited metal that is not fused to the parent metal.

*Parent metal*—The original metal of the joint sections.

*Penetration*—The depth to which the parent metal is melted by the arc—gaged by the depth of the arc crater.

*Recession*—The distance between the original scarf line and the average depth of penetration parallel to this line obtained in the completed weld.

*Re-entrant angle*—The angle between the original surface of the parent metal and the overlapping, unfused deposit edge.

*Scarf*—The chamfered surface of a joint.

*Tack*—A short deposit, from $\frac{1}{2}$ in. (13 mm.) to 2 in. (5 cm.) long, which serves to hold the sections of a joint in place.

*Weaving*—A semi-circular motion of the arc terminal to the right and left of the direction of deposition, which serves to increase the width of the deposit, decrease overlap and assist in slag flotation.

*Welt*—The material extending beyond the surface of the weld shanks to reinforce the weld.

## QUESTIONS AND ANSWERS

What does the welder's equipment consist of?

Welding generator, electrode holder with cables, welding booth, helmet or shield, gauntlets, high shoes with bellows tongue, heavy clothing or leather apron, proper electrodes.

What is the most important precaution the operator should observe?

To protect his eyes and body from the radiant energy emitted by the arc.

How is the operator prevented from drawing too long an arc after the electrode "freezes" to the work?

By twisting the wrist sharply to the right or left, thereby shearing the fused area.

What is the essential factor in securing the maintenance of the arc?

The electrode should be advanced to the work at the rate at which it is being melted.

What is the test of an operator's manipulative ability?

He should be able to hold an arc no longer than $\frac{1}{8}$ in. (3 mm.), having a voltage across it less than 25 during the period required to deposit the metal from a $\frac{5}{32}$ in. (4 mm.) diameter bare electrode, 12 in. (30.5 cm.) long on 150 amp. direct current.

What is meant by "free distance," "overlap," "parent metal," "penetration," "recession," "re-entrant angle," "scarf," "tack," "weaving" and "welt"?

Given under "Terminology."

What function does the arc perform?

It transforms electrical energy into thermal energy.

What polarity should the welder use on welding all but thin sections with bare electrodes?

The pencil electrode should be negative.

How may the amount of oxide formed be reduced to a minimum?

By holding a short arc and the use of electrodes containing a small quantity of carbon (0.18 per cent) and manganese (0.50 per cent).

How may an operator determine the degree of fusion obtained (a) by inspecting the surface, (b) by inspecting the cross-section of deposit?

(a) By examining the contour of the surface, noting the re-entrant angle and estimating the overlap; observing the depth of crater and estimating the penetration.

(b) By directly observing the depth of penetration or recession, the overlap and porosity or blow holes.

What are the factors in arc welding that determine the degree of fusion?

Arc current, arc length, electrode current density, electrode material, freedom of weld from oxides.

How may a welder determine when he is using the proper welding current?

By the depth the arc melts the material welded. The crater should be not less than $\frac{1}{16}$ in. (1.6 mm.) in depth.

What is the most important thermal characteristic encountered in welding?

Contraction of the hot deposit.

How may strains produced by this characteristic be minimized?

By adopting a correct welding procedure, either non-rigid or rigid, which serves to partly anneal the metal and reduce "locked-in" stresses.

What is the effect of holding too long an arc with the metallic electrode?

The use of a long arc produces a poor deposit, due to insufficient penetration, and also produces a large amount of oxide which reduces both the strength and ductility of the joint.

What size of bare electrodes corresponds to welding currents of approximately 225, 155, 100 and 60 amp. on welding with direct current?

$\frac{3}{16}$ in., $\frac{5}{32}$ in., $\frac{1}{8}$ in. and $\frac{3}{32}$ in. (4.8, 4, 3 and 2.4 mm.) respectively.

How should joint sections be prepared for welding?

The surfaces should be thoroughly cleaned and the faces of the joint scarfed to an angle of 60 deg. to 90 deg. with the edges separated a free distance of approximately $\frac{1}{8}$ in. in the rigid welding process, and an additional $\frac{1}{16}$ in. per foot from the point welded for each foot length when using the non-rigid system.

What surface characteristics denote fusion?

Surface porosity, amount of oxide coating, depth of arc crater, surface contour, compactness, regularity and re-entrant angles.

## SELECTED BIBLIOGRAPHY

The purpose of the above training course is to familiarize the welder with the basic characteristics and operations of the bare metallic electrode arc-welding process so that he may have an intelligent conception of the factors involved as well as be prepared for production work in the shortest time. To assist in his further development this course may be supplemented by study of the information contained in the following references:

"Welding of Mild Steel," by H. M. Hobart; *Proceedings A. I. E. E.*, April 1919, and *A. I. M. E.*, February, 1919. Abstracts data obtained by the investigations undertaken by the welding committee of the Emergency Fleet Corporation; gives the results of Writ-Jones tests of $\frac{1}{2}$-in. (13-mm.) arc-welded ship plate.

"Fusion in Arc Welding," by O. H. Eschholz; *Proceedings A. I. E. E.*, March, 1919. Describes such characteristics as penetration, overlap, surface contour, etc., obtained in arc welding.

"Electric Arc Welding"; Circular No. 7149 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Describes the welding equipment, welding processes, applications and terminology.

"Electric Arc Welding in Tank Construction," by R. E. Wagner; *General Electric Review*, December, 1918. Describes the welding of small and large tanks by the non-rigid method.

"The Training of Electric Welders," by H. A. Hornor; *General Electric Review*, December, 1918. Gives the experience of the Emergency Fleet Corporation.

"Arc Welding in Railroad Shops," by B. C. Tracy; *General Electric Review*, December, 1918.

"The Application of Electric Welding to Ship Construction," by H. J. Cox; *Proceedings Society of Naval Architects and Marine Engineers*, November, 1918. Describes the structures and method of welding used and gives welding speed and cost data.

Report of committee on arc welding, convention of the Association of Railway Electrical Engineers, Oct. 29-31, 1918; reprinted in subsequent issues of the *Railway Electrical Engineer*. Describes arc-welding systems, equipment, weld nomenclature and gives instructions for training operators.

"Electric Arc Welding"; Bulletin No. 104-A issued by the Lincoln Electric Company, Cleveland, Ohio. Illustrates welding applications supplemented by a course of instruction.

"Selection and Application of Electric Arc-Welding Apparatus," by A. M. Candy; *Electric Journal*, September, 1918. Describes standard equipment, discusses the circuit and weld characteristics, illustrates applications.

"Electric Welding—A New Industry," by H. A. Hornor; *Proceedings A. I. E. E.*, September, 1918. Describes the experience of the Emergency Fleet Corporation in ship welding.

"Inspection of Metallic Electrode Arc Welds," by O. H. Eschholz; *Railway Electrical Engineer*, July, 1918.

"Arc Welding of Mild Steel," by O. H. Eschholz; *Electric Journal*, July, 1918. Describes the process and weld structure.

"Welding Cast Iron with the Electric Arc"; *Railway Electrical Engineer*, May, 1918. Describes the methods used by the New York Central Railroad for repairing large castings.

"Electric Arc Welding Applied to Cast Iron," by B. W. Bowers; *Foundry*, Vol. 46, pp. 156-159. Describes process of welding defective castings.

"Welding Transformer Tanks by the Electric Arc Process," by Erik Oberg; *Machinery*, January, 1918. Describes the process of welding tanks $\frac{1}{8}$ in. to $\frac{3}{4}$ in thick.

"Electric Arc Welding," by Erik Oberg; *Machinery*, December, 1917. Illustrates various types of joints and describes a number of applications.

"Some Recent Investigations in Arc Welding," by O. H. Eschholz; *Proceedings A. I. and S. E. E.*, December, 1917, p. 697.

"Welds—the Weaknesses and Merits of Their Structure," by P. A. E. Armstrong; *Power*, June 26, 1917. Discusses locked-in stresses produced by the contraction of the deposit and methods of welding to minimize them.

"War and Welding," by E. Wanamaker; *Proceedings Western Railway Club*, September, 1917. Describes the experience of the Chicago, Rock Island & Pacific Railway Company in arc welding and gives the relative costs of arc and acetylene welds. An appendix describes the course of instructions in use by the C., R. I. & P. at Chicago.

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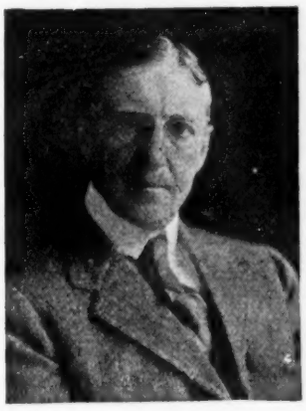
THE people of every country are at present endeavoring to ascertain how they can most readily improve their pecuniary standing by reconstruction and readjustment, to secure their full share or more of the wealth of the world; and foreigners are gazing upon this country as the most fertile field of adventure and exploitation. They will carry their endeavor into the markets of non-producing countries. By every known plan of operation producers in Great Britain, France, Germany and other lands will seek to control or excel in the oversea trade. Long before the war was ended committees were formed and studies commenced by them with the idea of entering a post-war commercial strife for the world's business.—*E. H. Gary.*

# Manufacturing Developments in the Industry*

## Period Where Every Other Consideration Had to Yield to Production Is Past and Resourcefulness and Will to Do Can Be Depended on to Accomplish Great Things in the Future

BY FRANCIS C. PRATT
Vice-President General Electric Company



F. C. PRATT

ALL the intensive war activities are rapidly becoming a part of the history of the past, and the responsibility now rests upon us to build again for the future.

We have perforce neglected our ordinary interests so extensively during the past two years in the way of making new developments for articles of our own manufacture that it has now become essentially necessary that our engineers and manufacturing people should concentrate their attention upon improving designs and manufacturing equipment for our own product, in order to maintain them at the highest possible state of efficiency.

We have just passed through a period where everything else had to yield to production, and that some mistakes were made was inevitable. We keenly appreciate that among our most important customers, such as public service corporations, the question of continuity of service is of paramount importance and are endeavoring to so conduct our business as to protect them in every possible way.

### Optimism for the Future

I am optimistic in regard to the future because out of the great war activities has sprung a resourcefulness and a will to do which not only have accomplished but will continue to accomplish great things. In fact, the new fields of activity opening before us would seem to be only limited by our ability to cope with them.

I wish now to refer briefly to some of the more important and interesting investigations and commercial developments which have either been completed during the past three years or else are now being actively pursued by our engineers or laboratory staffs.

The quality of our watt-hour meters and instruments has been considerably improved and new sizes and types developed, as demanded by the trade. There have been no fundamental changes of recent date.

The Warren clock has been commercially introduced, and we believe it offers interesting possibilities to the central-station manager in the way of improved regulations of circuit frequencies and further popularization of the use of electricity among his customers.

An important reduction in the variety of types of fan motors has been brought about with resultant advantages from both a manufacturing and a merchandising point of view.

A very remarkable demand for fractional-horsepower motors has taken place, largely on account of the constantly increasing popularity of electrically driven household appliances.

A serious effort has been made to help bring about a greater simplification of design, manufacture and distribution of domestic heating devices through the formation of the Edison Electric Appliance Company.

Important improvements have been made in the design and manufacture of industrial heating units and in their application to such purposes as japanning, shoe machinery, embossing machines and many others. As in many other cases, these improvements have partly resulted from experience gained in meeting the requirements for war material. There is a rapidly increasing demand for industrial applications.

A large number of complete electrical equipments for Heroult arc furnaces have been furnished to the steel trade and are operating very successfully. The General Electric automatic electrode regulator has made the arc furnace business much more attractive to the central station by producing a balanced load and minimizing fluctuations and at the same time providing a high load factor. It is therefore meeting with increasing appreciation not only in this country but abroad.

### Demand for Electric Furnaces

An active demand exists for electric furnaces, of which we have developed several types for melting brass and other alloys, owing to the greater economy of these furnaces as compared with other types.

Interesting investigations are being made of the induction furnace. In the past five years our lines of alternating-current and direct-current standard motors have been entirely redesigned with improved constants, insulation and utilization of material. Aluminum cast rotors have been largely adopted in the manufacture of our alternating-current motors, and the A. I. E. E. standard ratings have been fully followed. Special mention might be made of new lines of automatically starting induction motors, vertical motors, special steel and sugar-mill motors, oil-well pumping motors and winch and other motors for use on cargo ships.

* From an address before the Association of Edison Illuminating Companies, New London, Conn., Sept. 15 to 18.

In connection with protective devices I would call attention to the oxide film arresters, which represent a great advance over anything previously exploited.

These arresters have for most purposes practically the same characteristics as the aluminum-cell arresters, but require no charging or special attendance.

Interesting investigations are being made of arcing ground suppressors, but they are by no means yet completed.

Static condensers are meeting with increased favor. They correct the power factor in connection with induction motor or similar loads, are satisfactory for small outputs and require no attendance. Proper application of these condensers shows a decided saving in the proportion of generated power available for distribution. They do not encroach upon the legitimate field of the synchronous condenser.

Very considerable improvements have been made in the mechanical construction and insulation of our larger transformers, particularly in the way of increasing the protection against damage from short circuits.

The introduction of conservator tanks enables the tanks to be always completely filled with oil, thus better avoiding the introduction of water and reducing explosion danger and sludging.

Feeder regulators have been developed in larger sizes and also for outdoor use. Their auxiliaries have been improved.

In connection with our switchboard devices the introduction of the unit system of instruments and panels makes it possible to produce a variety of desired combinations in minimum time and to give our customers the best possible service in the way of replacements and repair parts.

The safety or dead-front boards, both of the fixed and truck panel type, have been introduced and are in demand.

### Tests of Oil Circuit Breakers

Very considerable progress has already been made in determining more accurate ratings of oil circuit breakers. We are now making ready for installation, at an initial expenditure of more than $150,000, a special generator and necessary auxiliaries which will enable us to carry on more advanced and difficult tests of large sizes of oil circuit breakers. This generator has a nominal rating of about 30,000 kva., 13,200 volts, and can also be connected for 6600 volts. It can deliver 36,000 amp. at a maximum possible instantaneous peak. This apparatus will be ready for operation in the very near future, and we are prepared to spend many thousands of dollars in carrying out a series of most important tests which have hitherto been impracticable.

New lines of the wattmeter-type relays having an extremely high degree of accuracy have been developed.

As conducive to more economical machines, and no doubt more economical hydraulic installations, an active demand has arisen for alternating-current generators running at higher speeds than in the past. Quite difficult design problems have to be solved in order to make these machines safe for the overspeed conditions required by the waterwheel drive.

The increasing export demand for 50-cycle machines emphasizes the handicap placed on the world's electrical industry by the variety of frequencies in use.

Several machines have been built for higher than our standard voltage of 13,200, the highest voltage of these machines being 22,000. Insulation tests indicate that there should be no serious difficulty in building large machines for such voltages.

The varnishes used in our insulations have recently been materially improved, enabling us to make more compact coils and thus reduce internal corona.

Our flexible-seat thrust bearing used on vertical machines has been quite generally applied with very satisfactory results.

We are prepared to build totally inclosed alternating-current generators for outdoor service, ventilating air being taken in and exhausted through ducts.

Automatic control of small hydroelectric generating stations is entirely feasible. One installation of 1500 kva. has operated for over a year and a half in an entirely satisfactory manner, our customer reporting "no trouble whatever."

The flashing over of 60-cycle synchronous converters has been practically eliminated by the use of the barrier system and a very high-speed circuit breaker. This combination guards against disturbances on both the direct-current and alternating-current sides of the system and has made it possible to freely use 60-cycle machines in railway work.

I am happy to say, in connection with railway work, that the first of the 165-ton, 3000-volt direct-current bipolar gearless passenger locomotives for the Chicago, Milwaukee & St. Paul Railway has gone through preliminary tests in a very satisfactory manner. It is of interest to note that the extreme difficulty of installing a motor-generator set for use in regenerative braking on this locomotive has been successfully overcome by utilizing the driving motors instead.

### Power-Limiting Device

I wish also to call attention to the power limiting and indicating apparatus installed for the first time on the Chicago, Milwaukee & St. Paul Railway. I believe that this apparatus will be of interest to you in relation to the sale of power for railway loads, as its function is to limit peak loads to a predetermined value and as it does much to eliminate the violent fluctuations and poor load factor of this class of business.

There are fourteen substations on the Chicago, Milwaukee & St. Paul, serving 440 miles of trolley and aggregating 60,000 kw. total capacity. Seven of these substations are controlled by one power-limiting device operated over a pair of No. 8 B. & S. pilot wires, starting at the train dispatcher's office at Deer Lodge and connecting all seven substations. The aggregate load of these seven substations is limited to 14,000 kw. peak, with an average of nearly 9000 on certain days and 8000 average for the month, thus producing a very good load curve of approximately 60 per cent. The demand for power upon the group of seven substations is limited by an automatic reduction in the 3000-volt trolley potential whenever the aggregate load tends to build up to more than 14,000 kw. peak. The 3000-volt direct current is supplied by motor-generator sets, making it easy to effect a voltage reduction by means of relays operating across the separately excited fields of the generators. Before the installation of this device the peaks on the Chicago, Milwaukee & St. Paul for seven substations reached 21,000 kw. They are now limited to 14,000 kw., thus raising the load factor from 40 to 60 per cent.

The cost of operating small substations on railway

systems has also brought about a constantly increasing demand for automatic substations. We have sold up to this time sixty-six of these stations and feel that the success of automatic control is assured. The substation functions previously performed by an attendant are now automatically accomplished electrically, and substations so controlled have no attendants whatever beyond a periodic inspection. Owing to this method of reducing the cost of operating substations it becomes possible to consider their use in many places previously barred on account of the high cost of operation.

In connection with central stations the advantages of flow meters for use in checking boiler operations are being more generally recognized. The substitution of flow nozzles for nozzle plugs and other improvements in detail have greatly increased the reliability of these devices.

### Equipment of Battle Cruisers

The importance to the General Electric Company of correct decisions as to design and construction of large generating units is emphasized by the extent and character of our undertakings in ship propulsion, the largest item of these being the equipment of battle cruisers. We are working on contracts for the machinery of four of these vessels having an aggregate capacity of 720,000 shaft horsepower and calling for sixteen 35,000-kw. generating units. The price of these equipments aggregates over $11,000,000, and their acceptance is, as usual, dependent upon a perfect performance of their functions. In these units design should be adapted to high economy under a wide range of loads and speeds, conditions quite different from those in a land power station. For these reasons the turbine may be built with one two-bucket stage at the high-pressure end, but in other respects will be very similar to the commercial machines which we are now producing.

In the case of certain very large merchant ships on which we are figuring, equally large units will be required which should give the best attainable efficiency at full load, and for these a careful study seems to indicate the desirability of machines like those which we are building for large land stations.

With reference to prime movers, it is only proper to state that most earnest and comprehensive investigations are being made of the possibilities of still further improvements in the efficiency and reliability of such machines, including our investigations of the mercury turbine

Following the Panama Exposition, a campaign was started for the purpose of raising the standard of illumination. Installations having standards bearing three 6.6-amp. luminous-arc lamps each were made at both Salt Lake City and San Francisco. Following this two-light standards were designed and have since been installed for the entire business district of San Francisco and the principal business street of Los Angeles. In connection with this intensive lighting it is important to note that there has been a general increase in show window and billboard lighting in the districts illuminated. The war temporarily put a stop to the campaign, but since the armistice active work has again been taken in hand and standards have been designed for a number of cities.

At Saratoga contracts have recently been closed for the new system of lighting for the main street and Congress Park. A two-light standard is used on the main street, the lighting unit being the new Duoflux fixture. This fixture contains a large and small lamp operated by the use of a relay to burn either the large or both lamps until midnight and the small lamp after midnight. In Saratoga a 1000-cp. lamp will be burned until midnight and a 250-cp. lamp after midnight. Only one circuit is used, the operation being performed by short-circuiting the constant-current transformer at the station.

In general street lighting has been greatly improved by replacing inclosed carbon arc lamps with Novalux incandescent units. A line of lighting fixtures both of the pendent and ornamental types for incandescent lamps of all sizes has been developed, and thousands of these are now in use throughout the country. By using the refractor, in connection with our new designs of fixtures, particularly with the pendent-type lamps, a great quantity of light which was heretofore wasted is now thrown on the street.

Improved designs of fixtures and globes have been made for the luminous-arc lamp and the efficiency of the electrode has been greatly increased. The 4-amp. luminous-arc lamp can now be operated with the high-efficiency electrode, which will give 55 per cent more light than the standard electrode.

The first floodlamps were put in operation at the Panama Exposition, and following this several types were designed for various classes of work. Many thousands of these have been used for the illumination of public buildings and the protection of property.

### Incandescent Lamps for Searchlights

Special incandescent lamps have been developed for searchlight use. Those which are commercially obtainable operate at 100 amp., 11 volts. Such a lamp with an 18-in. (45-cm.) mirror will give 5,000,000 maximum-beam candlepower. With the 30-in. (75-cm.) mirror it will replace the present 18-in. arc searchlight. The life of the lamp is from 100 to 200 hours. This development is being continued, and lamps of much higher voltage are being experimented with. At the present time apparatus is being built for the lighting of aviation landing fields. Incandescent searchlights with specially designed signaling devices will be used.

Notable improvements have been made in arc lamps for searchlights.

Prior to the war the greatest candlepower searchlight was a 60-in. plain carbon, 175-amp. lamp, giving about 30,000,000 cp. During the war carbons were developed which would permit intensifying this arc so that a beam of 200,000,000 cp. could be obtained.

A high-intensity searchlight was developed under the Beck patents which will give a beam candlepower of approximately 500,000,000. This type of searchlight is now the navy standard, and a lamp has also been made which can be used in the army's anti-aircraft open-type searchlight.

A mirror of deposited silver with a backing of copper and cement for searchlight use is now being perfected.

### Laboratory Work Resumed

When the armistice was signed the laboratory at once took up again its customary work and has gone largely into accumulated factory matters.

Our "Mazda" service is being strengthened. The quality of glass in general and the "shrinkage" in the factory are also being studied. Vacua "getters" for in-

creasing lamp life are being studied. Special new lamps and wire, particularly alloy wires for filaments, are being worked on. The more remote and radical studies in lamps are now in process of investigation. Improvements are being worked out in methods of obtaining and distributing information relating to lamps.

Work on motor and generator brushes is continually growing and improving. These results are important as they give latitude in the design of apparatus and insure good operation in otherwise questionable cases.

Our laboratory electric furnaces, in addition to routine work, are also running various experimental steels for such purposes as rustless turbine buckets and special tools where there is a wide field for progress.

There are also running several lines of experimental work on erosion and corrosion of alloys, having in view their use in turbines, where, owing to some peculiar condition, such as salt water, the service for ordinary steel is severe. Several months have also been spent on mechanical and physical tests in connection with stronger and lighter turbine wheels.

A great deal of work on oils and varnishes has led to a better insulating varnished cloth and to new mica tape, which are now used in large quantities. By this same work molded paper insulation and even changes in insulating methods are also being developed.

The study of water japan was started prior to the war in order to get a japan which would avoid the menace arising from fires or explosion in the baking. We have particular reference to electrically heated japanning ovens, although the danger is at least as great in gas-fired ovens. In electrically heated ovens the tendency has always been to reduce the air circulation in order to save energy, and this finally reached such a state in some places as to produce spontaneously inflammable, or even explosive, mixtures of air and naphtha, the latter being used as a solvent for the japan base. We are now operating at Schenectady our own japanning plant on the new water japan. There is no inflammable gas connected with it, and there seems to be no reason why we cannot count on putting this into general use.

X-ray work is exceedingly active. There is a great deal ahead of us here, because the medical profession are now doing so much reliable and sane work with X-rays. The day may well come when many of the electric service stations will be called upon by doctors to send a man with his portable outfit to the home of a patient for the purpose of making immediately visible to the doctor the patient's condition, or pressing the button for a photographic plate exposure.

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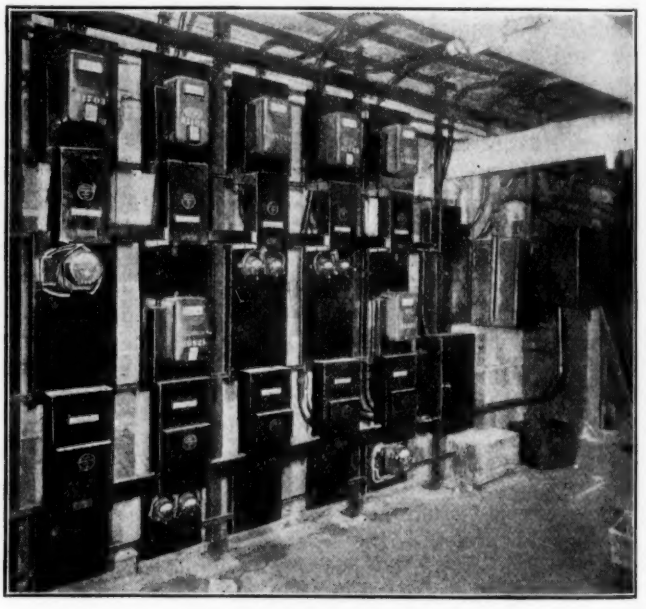
TO THE day's work. If it be to protect the rights of the weak, whoever objects, do it. If it be to help a powerful corporation better to serve the people, whatever the opposition, do that. Expect to be called a standpatter, but don't be a standpatter. Expect to be called a demagogue, but don't be a demagogue. Don't hesitate to be as revolutionary as science. Don't hesitate to be as reactionary as the multiplication table. Don't expect to build up the weak by pulling down the strong. Don't hurry to legislate. Give administration a chance to catch up with legislation.—*Governor Calvin Coolidge of Massachusetts.*

## IMPROVING CUSTOMERS' UNDERGROUND SERVICE

### Piecemeal Growth of Sub-sidewalk Installation Leads to Construction Being Standardized by a Central-Station Company

As a result of failure to place responsibility for work, careless installation by contractors, or sometimes neglect on the part of the central station, services leading into a property frequently develop into a tangled mass of cables and unsystematically arranged meters and switches which it is difficult to repair or extend and which are dangerous if trouble develops. The appearance of such installations does not inspire order and cleanliness. In fact, some have been found buried behind rubbish, wood piles or coal—a condition that is hazardous from a fire standpoint and one that does not contribute to the accuracy of meters or ease of reading.

Whenever possible, meters in service at the time such work is done are removed from the customers' floors



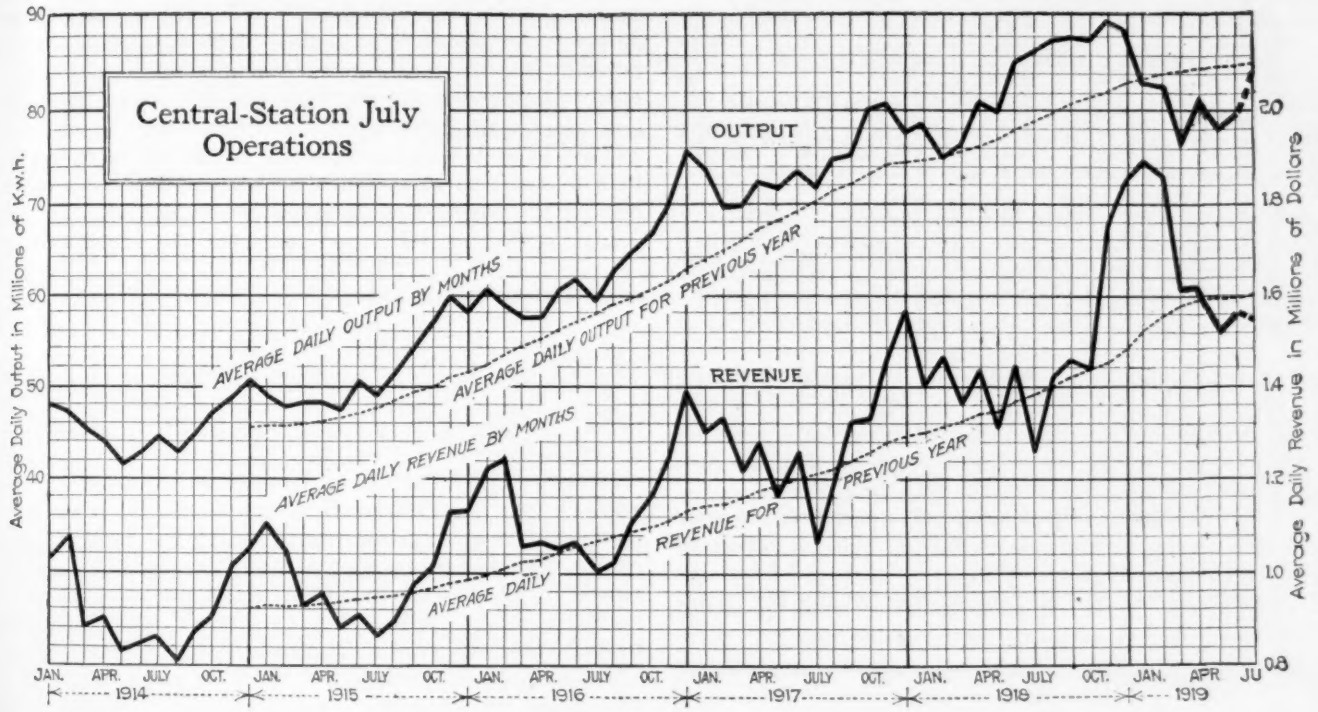
IMPROVED CONSTRUCTION ADOPTED

and provision is made for them on panelboards. In case the wiring is so arranged that it is impossible without considerable expense to change the location of such meters, a fuse block is installed on the panelboard to which are connected the building risers which supply energy to the meters.

The service mains for meters on the panelboard are laid in a rectangular metal troughing, which can be extended whenever it is necessary to supply additional customers. Taps are taken from these mains and connections made to Metropolitan protective meter-test blocks. From these test blocks connections are made to the meters.

The meters are mounted on 0.5-in. (1.27-cm.) asbestos lumber, which is bolted to the framework. All other metering equipment is mounted directly on the framework. All troughing and meter housings are covered with a high grade of baked enamel. Metal plates are attached to each meter housing, designating the floor location of the customer connected to the meter in question. In addition, all switch and fuse cabinets and housing installed on the meter panelboard are sealed.

# Consistent Earnings Record Maintained




THE impressive feature of central-station operations for the month of July, as deduced from the returns furnished the ELECTRICAL WORLD by operating companies, is the increase in power output. July is normally the lightest month in the central-station business, for the long days curtail the lighting requirements and industrial production is likely to be less energetic. But this July was exceptional in that, as compared with June, output increased fully 11 per cent. In fact, the total production of energy almost reached that of July, 1918.

No less impressive is the showing in central-station revenues. The good record of consistent earnings established during previous months was maintained, and a comparative increase of 12 per cent over July, 1918, is shown. The second half of 1919 thus starts off with every indication of strength and activity in the central-station field.

The regional groups show varying reactions to changes in industrial conditions. The gain in output in New England was remarkable, the increase over June being 21 per cent, coming for the most part from the Connecticut valley. In the Atlantic States increases over June averaged about 9 per cent, the important

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

| | Month | Percentage of Industry Represented | New England States | | Per Cent Increase | Percentage of Industry Represented | Atlantic States | | Per Cent Increase | Percentage of Industry Represented | Central States | | Per Cent Increase | Percentage of Industry Represented | Pacific and Mountain States | | Per Cent Increase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | |
| REVENUE | Aug. | 63 | $3,138,000 | $2,585,000 | 21.4 | 63 | $10,147,000 | $8,722,000 | 16.3 | 51 | $8,223,000 | $6,823,000 | 20.5 | 85 | $5,383,000 | $4,560,000 | 18.0 |
| | Sept. | 64 | 3,268,000 | 2,811,000 | 16.2 | 57 | 10,143,000 | 8,631,000 | 17.5 | 51 | 9,251,000 | 7,703,000 | 20.1 | 86 | 5,389,000 | 4,665,000 | 15.5 |
| | Oct. | 63 | 3,360,000 | 3,036,000 | 10.6 | 51 | 8,822,000 | 7,924,000 | 11.3 | 50 | 9,218,000 | 7,848,000 | 17.4 | 81 | 4,854,000 | 4,420,000 | 9.8 |
| | Nov. | 64 | 3,695,000 | 3,238,000 | 14.1 | 55 | 11,877,000 | 10,400,000 | 14.2 | 50 | 9,277,000 | 7,704,000 | 20.4 | 81 | 5,034,000 | 4,552,000 | 10.6 |
| | Dec. | 64 | 4,097,000 | 3,449,000 | 18.7 | 55 | 11,927,000 | 10,199,000 | 16.9 | 50 | 10,781,000 | 8,836,000 | 22.0 | 79 | 5,253,000 | 4,644,000 | 13.1 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 4,253,000 | 3,443,000 | 23.5 | 60 | 13,444,000 | 11,168,000 | 20.3 | 47 | 10,410,000 | 8,484,000 | 22.7 | 77 | 5,187,000 | 4,494,000 | 15.4 |
| | Feb. | 63 | 3,895,000 | 3,048,000 | 27.7 | 53 | 10,894,000 | 8,943,000 | 21.8 | 45 | 9,305,000 | 7,484,000 | 24.3 | 73 | 4,036,000 | 3,618,000 | 11.5 |
| | March | 64 | 3,608,000 | 3,044,000 | 18.4 | 58 | 11,731,000 | 10,244,000 | 14.5 | 47 | 9,012,000 | 7,447,000 | 21.0 | 81 | 4,218,000 | 3,685,000 | 14.4 |
| | April | 64 | 3,473,000 | 2,964,000 | 17.2 | 51 | 11,408,000 | 10,114,000 | 12.7 | 47 | 8,420,000 | 6,981,000 | 20.5 | 76 | 4,328,000 | 3,755,000 | 15.3 |
| | May | 62 | 3,194,000 | 2,800,000 | 14.0 | 51 | 9,430,000 | 8,571,000 | 10.0 | 47 | 8,297,000 | 6,888,000 | 20.4 | 77 | 5,468,000 | 4,764,000 | 14.7 |
| | June | 62 | 3,215,000 | 3,015,000 | 6.6 | 50 | 9,185,000 | 8,228,000 | 11.6 | 47 | 7,939,000 | 6,784,000 | 17.0 | 74 | 4,510,000 | 3,870,000 | 16.5 |
| | July | 49 | 2,371,000 | 2,057,000 | 15.2 | 42 | 7,223,000 | 6,526,000 | 10.6 | 31 | 4,383,000 | 3,698,000 | 18.8 | 52 | 1,170,000 | 1,171,000 | −0.1 |
| | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | | | 1918 | 1917 | |
| KW.-HR. OUTPUT | Aug. | 63 | 143,566,000 | 114,017,000 | 25.9 | 63 | 567,672,000 | 490,505,000 | 15.7 | 51 | 447,829,000 | 399,278,000 | 12.1 | 85 | 488,433,000 | 413,350,000 | 18.1 |
| | Sept. | 64 | 133,901,000 | 114,279,000 | 17.1 | 57 | 520,312,000 | 445,154,000 | 16.8 | 51 | 471,594,000 | 408,320,000 | 15.5 | 86 | 453,342,000 | 381,067,000 | 18.9 |
| | Oct. | 63 | 139,784,000 | 128,970,000 | 8.3 | 51 | 481,222,000 | 440,268,000 | 9.3 | 50 | 479,990,000 | 442,054,000 | 8.5 | 81 | 416,870,000 | 381,067,000 | 9.4 |
| | Nov. | 64 | 138,559,000 | 123,033,000 | 12.6 | 55 | 542,699,000 | 495,812,000 | 9.4 | 50 | 444,012,000 | 396,665,000 | 11.9 | 81 | 403,566,000 | 368,237,000 | 9.6 |
| | Dec. | 64 | 145,543,000 | 129,838,000 | 12.1 | 55 | 405,253,000 | 421,973,000 | 12.6 | 50 | 489,864,000 | 443,544,000 | 10.4 | 79 | 428,906,000 | 374,187,000 | 14.6 |
| | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | | | 1919 | 1918 | |
| | Jan. | 63 | 143,254,000 | 124,632,000 | 14.9 | 60 | 525,322,000 | 458,545,000 | 14.5 | 47 | 463,394,000 | 403,127,000 | 14.9 | 77 | 390,690,000 | 371,156,000 | 5.2 |
| | Feb. | 63 | 128,660,000 | 109,993,000 | 17.0 | 53 | 406,702,000 | 374,958,000 | 8.4 | 45 | 426,965,000 | 378,912,000 | 12.6 | 73 | 287,479,000 | 293,492,000 | −2.0 |
| | March | 64 | 125,510,000 | 124,707,000 | 0.7 | 58 | 459,166,000 | 461,096,000 | −0.4 | 47 | 442,591,000 | 423,802,000 | 4.4 | 81 | 330,714,000 | 331,769,000 | −3.0 |
| | April | 64 | 123,211,000 | 118,322,000 | 4.1 | 51 | 382,282,000 | 369,701,000 | 3.4 | 47 | 373,116,000 | 345,213,000 | 8.1 | 76 | 329,925,000 | 333,405,000 | −1.0 |
| | May | 62 | 120,949,000 | 122,531,000 | −1.3 | 51 | 362,207,000 | 383,860,000 | −5.6 | 47 | 389,805,000 | 375,944,000 | 3.6 | 77 | 382,637,000 | 385,543,000 | −0.7 |
| | June | 62 | 120,419,000 | 130,199,000 | −7.5 | 50 | 353,385,000 | 354,302,000 | −0.3 | 47 | 388,767,000 | 360,952,000 | 7.7 | 74 | 364,880,000 | 360,659,000 | 1.2 |
| | July | 49 | 91,200,000 | 84,960,000 | 7.3 | 42 | 296,864,000 | 304,047,000 | −2.4 | 31 | 183,724,000 | 177,242,000 | 3.7 | 52 | 104,146,000 | 113,019,000 | −7.8 |

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

| | Percentage of Industry Represented | Revenue from the Sale of Energy | | | Kw.-Hr. Output | | |
|---|---|---|---|---|---|---|---|
| | | 1918 | 1917 | Per Cent Increase | 1918 | 1917 | Per Cent Increase |
| Aug. | 61 | $26,891,000 | $22,690,000 | 18.5 | 1,647,510,000 | 1,417,150,000 | 16.3 |
| Sept. | 60 | 28,051,000 | 23,810,000 | 17.8 | 1,579,149,000 | 1,348,820,000 | 17.0 |
| Oct. | 56 | 26,254,000 | 23,228,000 | 13.0 | 1,517,866 000 | 1 392,359,000 | 9.0 |
| Nov. | 57 | 29,883,000 | 25,894,000 | 15.4 | 1,528,836,000 | 1,383 747,000 | 10.5 |
| Dec. | 56 | 32,058,000 | 27,128,000 | 18.1 | 1,539,161,000 | 1,369,542,000 | 12.3 |
| | | 1919 | 1918 | | 1919 | 1918 | |
| Jan. | 57 | 33,294,000 | 27,589,000 | 20.6 | 1,522,660,000 | 1,357,460,000 | 12.1 |
| Feb. | 54 | 28,130,000 | 23,162,000 | 21.4 | 1,249,806,000 | 1,157,275,000 | 7.9 |
| Mar. | 57 | 28,569,000 | 24 420,000 | 16.8 | 1,357,981,000 | 1,341,374,000 | 1.2 |
| Apr | 54 | 27,629,000 | 23,814,000 | 15.9 | 1 278 273,000 | 1,240,842,000 | 2.9 |
| May | 55 | 26,389,000 | 23,023,000 | 13.6 | 1,255,598,000 | 1,267,878,000 | −1.0 |
| June | 53 | 24,849,000 | 21,897,000 | 13.4 | 1,227,451,000 | 1,206,112,000 | 1.8 |
| July | 40 | 15,147,000 | 13,452,000 | 12.6 | 675,934,000 | 679,268,000 | −0.5 |

gains being chiefly in the South. The thriving condition of the central-station industry in the Middle West, commented upon in last month's review, is again emphasized, the output and earnings in a number of industrial centers exceeding the war-time level.

Favorable statements of production and revenue were received from companies supplying the oil fields of the Southwest and the coal mines of Colorado, but the metal-mining region still reports the demand for power very light.

# *Readers' Views and Comments*

## Overloading Old Generating Plant

*To the Editor of the* ELECTRICAL WORLD:

SIR: Engineers of fifteen to twenty years' experience in generating station work know well what heavy overloads equipment made twenty years ago will withstand and has endured. The man who has come along during the last ten years or so is apt to be a little cynical about such performances unless he has been in a hard-driven, old-fashioned station at some time. An excellent example came to the writer's notice a month or two back. Two small sets, originally put to work at 420 volts and 150 amp., became too small to be of much use. A turbine unit was installed which gave high economy and was capable of carrying rather more load than was available. Therefore the two old 150-amp. machines were disconnected from their engines and coupled together to form a motor-generator set to supply the traction load. This necessitated a voltage of 600, which was obtained by putting a series winding over the shunt coil. The series turns were put on experimentally until the desired results were obtained. At first too much load was "pulled" by the machines, but as 230 amp. and later 260 amp. was carried without any sparking or heating the series winding was again strengthened until the set carried the whole 150-amp. to 400-amp. load.

These two old machines are to-day carrying between 300 amp. and 400 amp. regularly, the variation being, of course, somewhat wider than that mentioned, though the maximum rarely goes over 400 amp. Until the 400-amp. loading is reached, there is no serious sparking, but at and after that point there is. Thus these two machines, after having put in fifteen years' good service on their rated output, have now been running for about three years with a load which, when the traction battery is in service, is always between 250 amp. and 350 amp. When the writer saw them running they were carrying all the load (just over 400 amp.) and had been doing so for about two months. The fact speaks well not only for the make of the machine but also for the resourcefulness of the engineer who experimented with and adapted the apparatus to its extra heavy work. The method at each load increase was to add an extra series turn or two and then to set the circuit breaker a little higher, the limit being increased at each trial.

Liverpool, England. MARK MEREDITH.

## Removal of Burned-in Material from Reflectors

*To the Editor of the* ELECTRICAL WORLD:

SIR: In a recent issue of your paper, under "Scientific and Industrial Research," I note the suggestion that a simple method be devised for removing burned-in material in the reflectors of magnetite-arc lamps. Your readers may be interested to know of the successful method of removing these particles in use by our company. The reflectors are washed like common plates, rinsed in clean water and then well scrubbed with pure muriatic acid. After this treatment the burned-in particle may be readily rubbed off with clean water. The porcelain is probably not quite so glossy after this process as when new. Great care should be taken to protect the skin and face from the acid fumes during this operation.

This method is substantially the same as that described by Alfred Herz in the Nov. 16 issue of the ELECTRICAL WORLD, 1918, for the removal of burned-in particles in arc lamps. SAMUEL B. MCBRIDE,

Salt Lake City. Utah Power & Light Company.

## Developed and Undeveloped Power on Androscoggin River

*To the Editor of the* ELECTRICAL WORLD:

SIR: In an article in the ELECTRICAL WORLD of Aug. 23, 1919, page 401, entitled "Potential Water Power and Coal Saving," the third paragraph begins: "According to Walter H. Sawyer, consulting and hydraulic engineer, Lewiston, Me., the total developed and undeveloped power in New Hampshire is:

| | — Present Conditions — | | With Additional Economic Storage | |
|---|---|---|---|---|
| Head, Ft. | 24-Hr. Hp. Low Water | 24-Hr. Hp. 60% of Time | 24-Hr. Hp. Low Water | 24-Hr. Hp. 60% of Time |
| Developed, 294 | 42,000 | 47,000 | 47,000 | 52,000 |
| Undeveloped, 268 | 37,400 | 44,180 | 44,180 | 48,800 |

The arrangement of this information, immediately following subject matter relating to the Connecticut and Merrimac Rivers, and immediately followed by other information in regard to the same rivers, is very misleading. The opening statement of the paragraph referred to should have been as follows: "According to Walter H. Sawyer, consulting and hydraulic engineer, Lewiston, Me., the total developed and undeveloped power on the Androscoggin River in New Hampshire is," etc. The letter written by myself had reference only to the Androscoggin River and to no other river in New Hampshire. WALTER H. SAWYER.

Lewiston, Me.

[Attention to the mistake pointed out by Mr. Sawyer was drawn in a recent issue by C. H. Pierce, district engineer of the United States Geological Survey.—ED.]

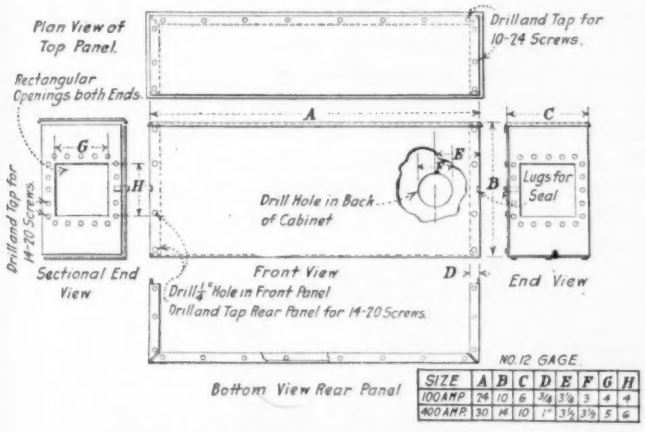
# STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

## SPECIAL JUNCTION BOX FOR SERVICE TAPS AT CURBS

### Details of a Standard Cabinet for Use in Underground Service Connections to Protect Cables from Moisture

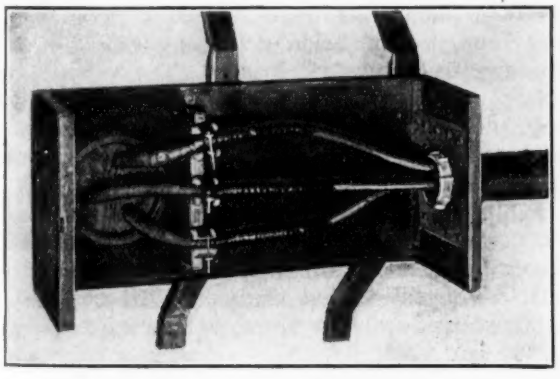
Owing to rain and water leaking through the sidewalk and curb wall where service mains enter a customer's property, one large central-station company




| SIZE | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 100 AMP | 24 | 10 | 6 | 3/4 | 3 1/8 | 3 | 4 | 4 |
| 400 AMP | 30 | 14 | 10 | 1" | 3 1/2 | 3 1/2 | 5 | 6 |

DETAILS OF SPECIAL SERVICE JUUCTION BOX

makes use of a special junction box for the protection of its cables, constructed as shown in the accompanying illustrations. These junction boxes or cabinets are made in two sizes, one used with No. 6 to No. 0 service cables inclusive, the other for service cables larger than No. 0. No. 12 U. S. gage sheet steel is used, being hot-galvanized after the cabinet is constructed. Porcelain cleats inside the cabinets are used



JUNCTION BOX WITH COVER REMOVED

to support the cables. The cabinets are so designed that the removal of the cover leaves only the back and two ends, permitting freedom in making splices. The top of the cabinet has projecting edges which prevent water from running down on the sides of the cabinet or entering it. This junction cabinet is supported by galvanized channel-iron brackets fastened by means of expansion bolts to the curb wall, a 4-in. (10.2-cm.) air space being allowed between the cabinet and the wall. A somewhat smaller junction cabinet is under consideration which will probably be made of cast iron instead of pressed steel.

## SPECIAL DEVICES FOR TESTING MANY WATT-HOUR METERS

### Use of a Revolving Table for Meters and Motor-Driven Chuck to Speed up Work in Test Department of a Central-Station Company

For speeding up the testing of watt-hour meters one large Western water-power company employs a revolving table that holds twenty meters. At this table, which is arranged as shown in the accompanying illustration, the tester always has his work in front of him and in easy reach of the testing board.

For use at this table a power-driven chuck is installed

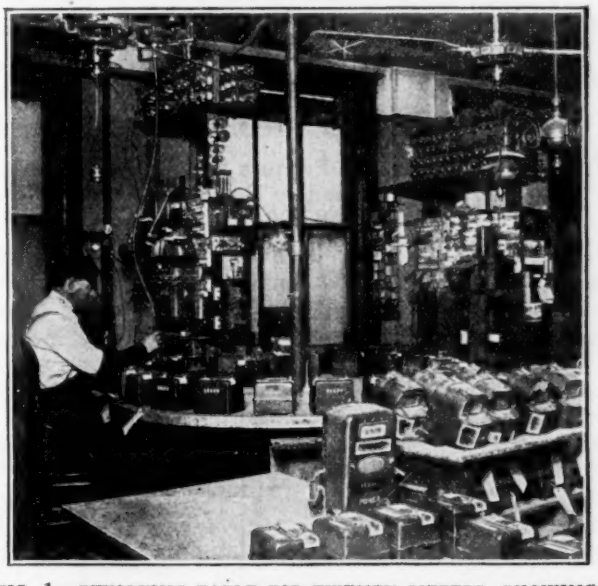


FIG. 1—REVOLVING TABLE FOR TWENTY METERS, SHOWING OPERATOR REMOVING WING NUTS WITH CHUCKS

that holds a screwdriver and a tool for holding wing nuts. This is used for taking off and replacing the wing nuts and taking out and replacing the four screws that hold the clock in place. This operation must be done at each test as all meters returned to the shop have their readings set to zero.

The motor-driven chuck, as shown in Fig. 2, consists of a small single-phase motor provided with a reversing switch so that the motor can be operated in either direction. Power is transmitted from the motor to the flexible shaft through a friction clutch. This clutch is operated by an electromagnet which is turned on and off by a finger key in the chuck. This key operates a relay which is necessary in order to do away with the injurious spark caused by the full current.

To provide against setting the screws and wing nuts too tightly a circuit breaker was designed to open the circuit at the proper time. This was accomplished by changing a watt-hour meter into a circuit breaker arranged to shut off the current intermittently when it

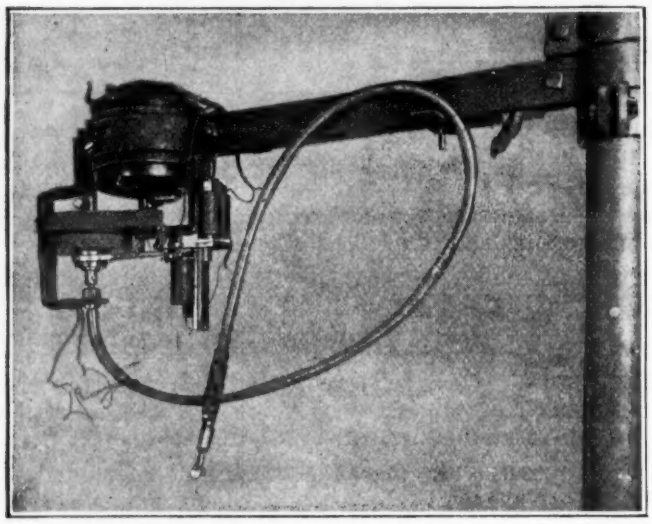


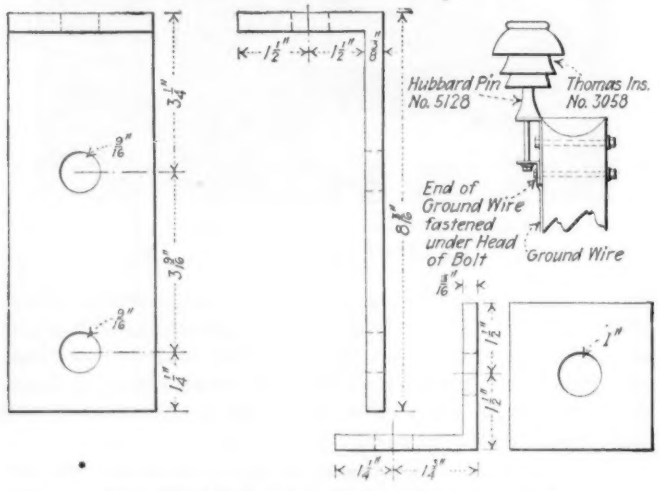
FIG. 2—MOTOR-DRIVEN CHUCK, SHOWING FRICTION CHUCK AND TYPE OF MOUNTING OVER REVOLVING TABLE IN FIG. 1

reached a certain value. In addition to being a time saver, this piece of apparatus has changed meter work from drudgery into pleasure.

## A POLE-TOP BRACKET THAT STAYS PROPERLY IN LINE

### Well-Designed Bracket Permits Triangular Spacing of Kind That Had Ceased to Be Popular on 33,000-Volt and 66,000-Volt Lines

In some of the early 33,000-volt transmission lines triangular spacing of the conductors was accomplished by the use of one cross-arm mounted about 3 ft. (1 m.) from the top of the pole and one pole-top bracket




MOUNTING FOR DISCONNECTING SWITCH FOR 33,000-VOLT LINE

at the top of the pole. With heavy lines and long spans, the brackets are not always able to stand the side strains. To overcome this trouble the Arkansas Light & Power Company has developed the pole-top bracket shown in the accompanying illustration, which, it is claimed, not only stays in line but will stand a reasonable amount of side strain.

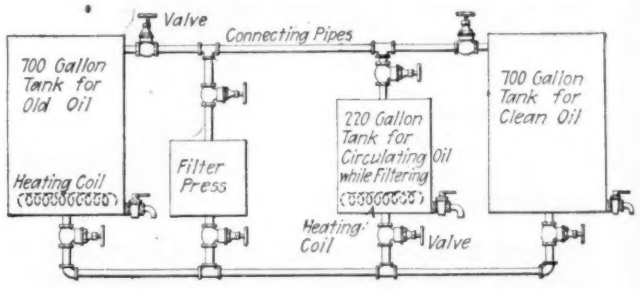
The holes provided for the insulator pin are bored large to facilitate installation in case of slight misalignment. For a ¾-in. (19-mm.) pin the pin hole in the large bracket piece is bored ⅞ in. (22 mm.) in diameter, and the hole in the angle iron is bored 1 in. (25 mm.) in diameter. It is usual practice to use ½-in. (12.5-mm.) through bolts.

## SYSTEM OF FILTERING DIRTY TRANSFORMER OIL

### Convenient Arrangement of Tanks and Filter Press for Filtering Large Quantities of Insulating Oil at High Temperature

A convenient arrangement of tanks and filter press has been devised by the testing department of the Sanitary District of Chicago for reclaiming used insulating oils. The scheme consists of connecting three tanks and a 30-gal. (115-l.) per minute filter press by pipe lines, as shown in the accompanying diagram. A valve is also fitted on each pipe leading to and from the tanks and filter press. By these means the oil may be passed from any tank through the press into any other tank or may be circulated continuously.

The 700-gal. (2650-l.) tank for the old oil is filled




HOW THE TANKS AND FILTER PRESS ARE CONNECTED

completely with the oil to be filtered. The oil is then heated by an electric heater in the bottom of the tank. The oil is allowed to stand for twelve hours to allow the sediment to settle. The temperature reaches about 100 deg. C., which drives off some of the water. The oil is then pumped through the filter press into the second tank, which holds 220 gal. (835 l.) and is equipped with an electric heater. The valves are set to allow the oil to circulate through this tank and through the filter-press, and the circulation is continued until the oil is purified. When the oil which has been filtered is too heavy it is diluted with new oil.

The filtered oil must withstand an insulation test of 24,000 volts between a $\frac{1}{10}$-in. (2.5-mm.) gap before it is considered fit for the storage tanks. When the oil stands the insulation test the valves are changed, and it is transferred into the third, or storage tank, which holds 700 gal. (2650 l.).

Great care is exercised in handling the filter press. The filter paper is dried for at least twelve hours at a temperature of not more than 85 deg. C. and is saturatd with dry oil as soons as it is removed from the oven. Five sheets of paper are used between each filter plate and the adjacent frame, and with dirty oil these are changed once every half hour, while for fairly clean oil once an hour is sufficient. Usually only one sheet of the five is replaced at a time, and after three replacements of single sheets an entire change is made.

## HOW TO DETERMINE RATING OF D.-C. BALANCERS REQUIRED

### Method of Figuring Size of Balancer Set Needed for Three-Wire System and Formula for Efficiency

In industrial plants where direct current is used it is often found desirable to use 230 volts for power circuits and 115 volts for lighting circuits; that is, a three-wire system of distribution is used. One way of obtaining the energy for a three-wire system is to use a single two-wire 250-volt generator together with one or more rotary-balancer sets. It is the function of the rotary balancer to maintain equal voltage division between the two sides of the three-wire system under all conditions of load from zero to full rated unbalanced load. The proper working of such balancer sets is obtained by making its two units exact duplicates in windings and magnetic qualities as nearly as possible. At no load both units act as motors running idle. When there is an unbalanced load the unit which is on the side of the greater load acts as a generator while the other acts as a motor. Because of this action of the two units, it follows that for ideal voltage division the generated emf. must be greater in the generator than it is in the motor. To cause this desirable difference in generated volts in the two machines, their field windings are usually arranged so that the excitation on the unit which acts as a motor is less than that of the generator. This adjustment of the excitation is entirely automatic and is obtained by means of suitable series fields.

The size of the balancers required for a given system depends on the amount of unbalanced load which may exist in the system. If, for example, it is assumed that the total load on a three-wire system is 100 kw., of which 70 kw. is supplied to motors at 230 volts and 30 kw. to lamps at 115 volts, the lamps being equally distributed on both sides of the system, it then follows that the maximum unbalanced-load conditions would exist when all lamps on one side of the system are being used and those on the other side are not used. That is, the maximum unbalanced load in this case will be 15 kw. or 130 amp., which means that the two machines of the balancer set must each be able to carry a little more than 65 amp. Thus the two units of the set must each have a capacity of 7.5 kw.

If at any time the unbalanced load should permanently increase over the capacity of the first set, a second set may be operated in multiple with the first. Balancer sets are operated in multiple in the same way as generators. Low-resistance equalizer connections have to be provided between the series fields to insure proper division of the unbalanced-load currents in proportion to the respective capacities of the sets. In addition, the load characteristics of the two sets have to be adjusted to make them share the load properly. These adjustments are made exactly as those required for compound-wound generators connected in multiple.

The efficiency of a balancer set may be figured if the following items are known.

$V$ = line voltage at the balancer set.

$E_t$ = terminal voltage of the unit which is connected across the larger load on the 115-volt line.

$I_s$ = amperes in the armature of the unit whose terminal voltage is $E_t$.

$I_m$ = amperes in the armature of the unit acting as a motor.

$I_f$ = amperes in the shunt-field winding of the two units. It is assumed that the two shunt fields are connected in series across the voltage $V$.

When these quantities are known the efficiency of the balancer set, when the unbalanced load current is equal to $I_s + I_m$, is:

$$100E_t \times I_g \div [(V - E_t) \times I_m + VI_f].$$

Balancer sets are necessarily started on the line before an unbalanced load is connected thereto, hence the sets are always started under no-load conditions. The starting equipment required for such a set, therefore, need not be of full capacity provided that it will continuously carry the maximum current passing through the armature of each unit on its last or short-circuiting contact.

H. H. METZENHEIM.

East Orange, N. J.

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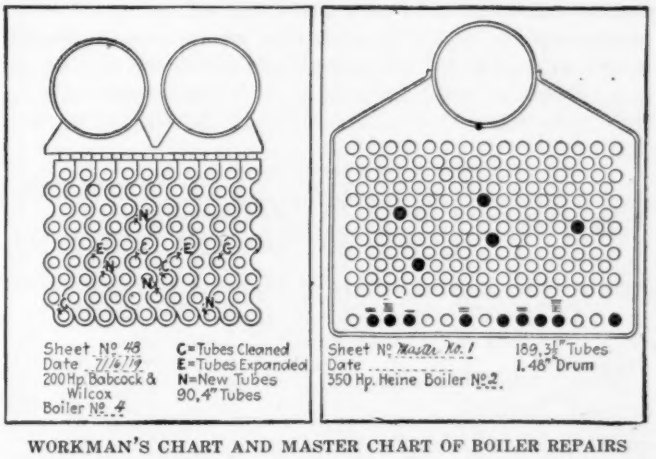
## METHOD OF TABULATING BOILER-REPAIRING WORK

### By Record of Cleaning, Expansion and Renewal It Can Be Immediately Known When Repairs Are Required Too Frequently

Because of trouble with boiler tubes some time ago the General Railway Signal Company of Rochester, N. Y., found it necessary to keep a record of the maintenance work so that too frequent repairs could be instantly observed. This was done by making charts as shown




WORKMAN'S CHART AND MASTER CHART OF BOILER REPAIRS

herewith and by requiring the repairman to fill out one of these sheets each time any work was done on the boilers. If he cleans, expands or renews a tube, he marks the chart with either a "C," "E" or "N" as the case may be and sends the chart to the office of the chief engineer. Here it is filed and a notation made on the master sheet if a tube has been renewed. The first time a tube is renewed the circle representing the tube is inked in, and each succeeding time a mark is placed immediately above the circle. If the number of marks above a certain tube becomes too great, an investigation is made and any extraordinary trouble is remedied.

After these charts had been in use for several months it was found that the lower layer of tubes in one boiler needed renewal at short intervals and the boiler was shut down in order to find the cause of the trouble. It was concluded that firebrick was needed to protect the tubes. After this material was installed no more than the ordinary amount of trouble expected developed.

E. E. JACKSON,

Chief Engineer General Railway Signal Company.

Rochester, N. Y.

# INDUSTRIAL APPLICATIONS

## The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

### BURNING BATTERY PLATES TO BUSBARS PROPERLY

**Too Much Dressing or Scraping Should Be Avoided to Prevent Reduction in Cross-Section and Therefore in Carrying Capacity of Parts**

When cleaning burned connections between storage-battery plates and busbars, too much scraping is usually done. A properly burned connection is smooth and surfaced with the top of the busbar and the plate lug without further dressing. Usually there is a small irregularity at the bottom, which may be dressed off with a file or scraper, but beyond this the connection should require no further attention. This means that correctly burned batteries require no dressing, and any installation that must be filed, scraped and sand-papered has evidently been badly and uneconomically made.

A further loss caused by dressing is the decrease in cross-section of all parts involved, affecting the current-carrying capacity and the mechanical strength, which make up two important items. Dressing as now carried out in some instances produces irregularity in these two items.

H. E. WEIGHTMAN.

Chicago, Ill.

### INDUCTION-MOTOR WINDING USED AS BALANCING COIL

**Permits Quick Restoration of Lighting in Plant When Coils on Three-Wire Circuit Are Damaged and New Ones Are Not Available**

Many central stations permit power customers to connect lighting circuits to the power line, but the 220-volt or 440-volt secondary service usually supplied for power purposes is not always satisfactory for lighting on account of unbalancing. The article on page 358 of the Aug. 16 issue of the ELECTRICAL WORLD showed the conditions under which one company allowed this practice, but other companies sometimes require balancing coils. One balancing coil between phases produces the desired result on a 220-volt power circuit, and two balancing coils may be used in series across 440-volt circuits. Where the lighting load is sufficient to unbalance appreciably the current per phase, balancing coils are connected across more than one phase and the load is balanced between them.

Balancing coils are reliable pieces of apparatus, but they will burn out sometimes if subjected to an excessive out-of-balance load. During the war a 3-kw. coil in a Milwaukee plant burned out so that it could not be quickly repaired, and it was impossible to get a new coil at the time. As an experiment the plant electrician took a 5-hp., 220-volt, three-phase squirrel-cage induction motor out of stock, removed the rotor and connected the three stator leads to the 110-220-volt three-wire lighting system. The motor windings performed their new functions very satisfactorily, and in half an hour after the balancing coil burned out the lights were back in service. A 3-hp. motor would have been large enough to replace the 3-kw. balancing coils, but the 5-hp. motor was the smallest spare machine on hand at the time.

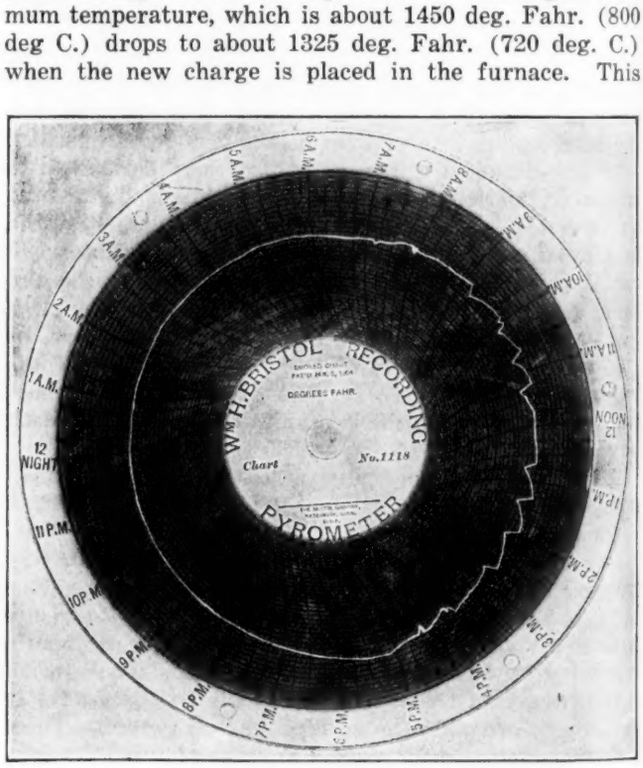
B. F. RUREY.

Milwaukee, Wis.

### TEMPERATURE VARIATIONS OF HEAT-TREATING FURNACES

**A Drop of 100 Deg. Fahr. Is Experienced During Charging Period and Normal Temperature Is Not Again Obtained for an Hour**

The temperature of an electric heat-treating furnace installed in the plant of the Pierce-Arrow Motor Car Company of Buffalo, N. Y., drops considerably when the door is opened for charging and withdrawing material. However, this automatically allows the metal to heat gradually, the maximum temperature being obtained when the operation is completed. The average maximum temperature, which is about 1450 deg. Fahr. (800 deg C.) drops to about 1325 deg. Fahr. (720 deg. C.) when the new charge is placed in the furnace. This particular furnace is capable of treating 160 lb. (72 kg.) per hour and requires 30 kw. for the process.




RECORD OF TEMPERATURE CHANGES

The temperature chart reproduced herewith shows that at 5 p.m., when the last metal is removed, the temperature has reached 1550 deg. Fahr. (845 deg. C.). The furnace switch is then set at its lowest position, which allows the furnace to draw 8 kw. With all of the

furnace doors shut tight it has been found that the temperature falls off to only 1350 deg. Fahr. (730 deg. C.) during the night up to 7 a.m., when the treating operations are again started. JOHN MILLER.

Buffalo, N. Y.

## DIAGRAMS FOR RECORDING COIL AND COMMUTATOR THROWS

### Method That Can Be Used by a Repair Man as an Aid in Duplicating a Damaged Lap or Wave Winding

When a burned-out armature is to be rewound in a repair shop with the same winding as originally used, some record should be made of the coil and commutator throws before the commutator is stripped. The diagrams that are used for this purpose in one large repair shop are shown in the accompanying illustrations. They are made use of as follows:

Before removing all of the coil terminals from the commutator necks, one coil is tested out to locate the slots in which the sides lie. The coil side in the bottom of a slot is designated as No. 1. The other side of the coil (in a double-layer winding) will be in the top of a slot, a distance which is called the coil throw. In Fig. 1 the bottom-coil side is in slot No. 1, and the top-coil side in slot No. 12, so that the coil throw is 1 and 12. Next the center line of the coil is determined and marked on the diagram so as to show whether it falls in a slot or on a tooth and also at the commutator on a bar or on a mica between bars. If the number of bars is an even number, the center line will fall on a bar, but if it is an uneven number, the center line will fall on a mica. In the case of a lap winding, commutator bar No. 1 is assumed to be directly under slot No. 1, as in Fig. 1. Then the number of bars is counted between bar No. 1 and the bar to which the terminal of the coil side in slot No. 1 is connected. This number is marked on the diagram. In Fig. 1 it is 4.

With the diagram marked in this manner, the remaining coils can be removed from the armature and the commutator removed if necessary. When repaired it can be replaced and lined up by means of the diagram.

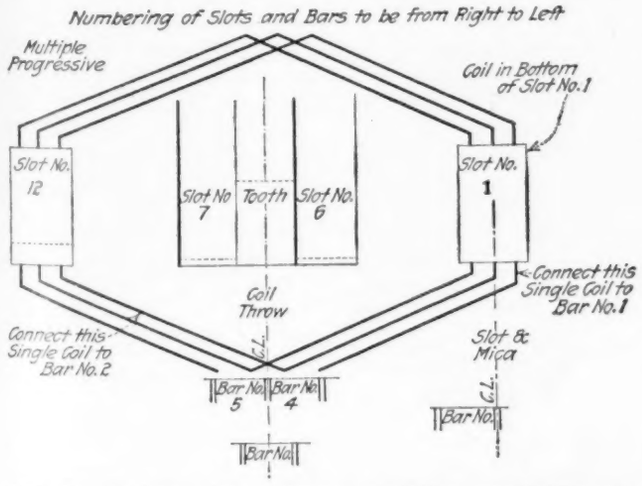



FIG. 1—DIAGRAM FOR ENTERING WINDING SPECIFICATIONS FOR A LAP WINDING

From the diagram the armature winder can also tell the type of coil needed and can easily locate the commutator bar to which the bottom lead of the first coil must be connected as the coils are placed in the slots.

In Fig. 2 the diagram used for a wave winding is shown and drawn in such a way that it can be used for a continuous-wave winding or one with a dead coil. The same procedure is followed as in the case of a lap winding except that bar No. 1 is taken as the one to whicl. the bottom-coil side is connected and the count to the center line of the coil made from bar No. 1 toward the

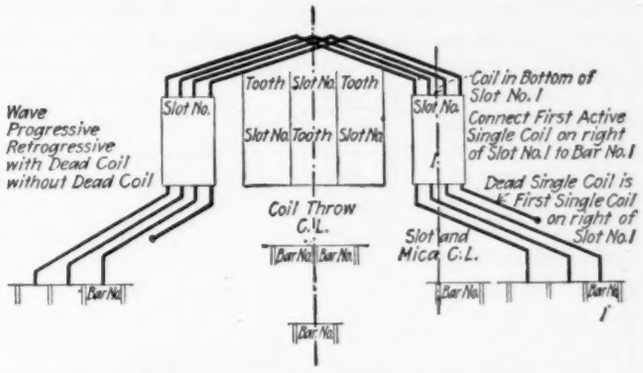



FIG. 2—DIAGRAM FOR ENTERING SPECIFICATIONS FOR A WAVE WINDING

left. Then the coil throw is marked in the slot spaces provided in the diagram, the center line of the coil being indicated as falling on a mica or on a commutator bar. In the former case the proper numbers are marked on the bars each side of that mica, and in the latter case the proper number is marked on the bar, always counting to the left from bar No. 1. It should also be noted whether the center line of the coil falls on a slot or a tooth, and the proper numbers should be entered.

## METHOD OF ASSEMBLING COMMUTATOR MICA AND BARS

### Heavy Band Is Drawn Tight Around Commutators—This Practice Brings the Parts Firmly in Place for Baking

After a commutator has been taken down for repair and new bars and mica insulation obtained, some care must be taken to assemble them accurately on the armature. The mica and copper bars may be painted with shellac and assembled on a face plate around a mandrel. One or more heavy iron bands are placed around the face of the commutator and drawn tight with bolt and nut. This assembly is baked until the volatiles have been driven off the shellac and the bars of copper and mica form a solid ring.

The assembled bars are put in a lathe and the chuck is clamped down on to the iron bands. The V-ring at one end is turned in this position and the inside bored out. A wooden mandrel is then turned to fit the bore of the assembled bars, which are pushed on to the mandrel, and the V-ring on the other end of the bars is turned. Tests are then to be made for short circuits.

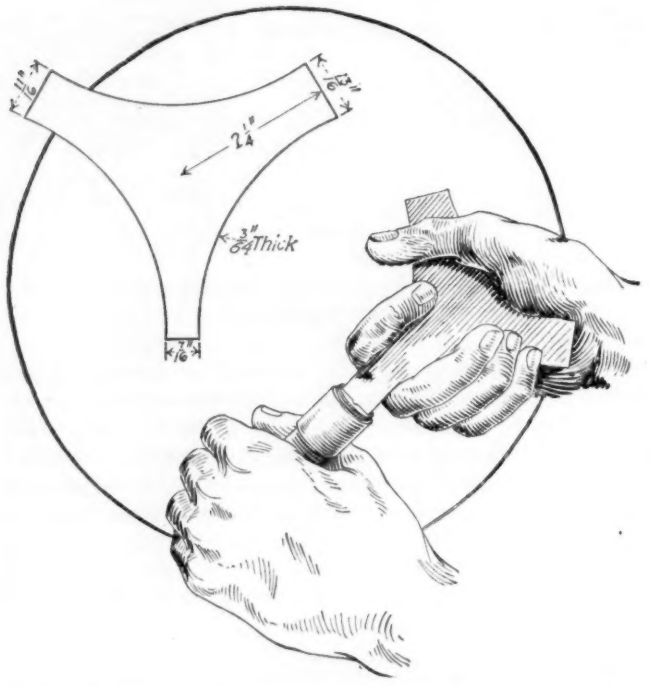
The assembled bars are then ready to be screwed or bolted on to the commutator spider or shell, but not before the latter has been thoroughly heated. Before the finished commutator is pressed on the shaft it should again be subjected to tests.

The commutator lugs need only be tinned where the commutator bars are very heavy or risers are used. When conditions make it necessary to tin the commutator lugs the work can be done more quickly with a blow torch than with a soldering iron.

## TOOL FOR REMOVING CAPS OF REFILLABLE FUSES

### Construction of a Three-Point Screwdriver That Will Fit the Cap of Three Sizes of Fuses

In the accompanying illustration a wrench is shown which the writer has found convenient for removing the caps of "Economy" refillable fuses without burring the slot as is often the case when an ordinary screwdriver




DIMENSIONS OF THREE-POINT SCREWDRIVER FOR REFILL FUSE CAPS

is used. The three blades are made to fit the screw slot of (0-30) 250-volt, (0-30) 600-volt and (0-60) 600-volt ferrule-type fuses respectively. The shape is such that two of the blades form a handle that enables a firm grip when the screw is set up tight. This device can be easily made from a 3-64-in. (1.2-mm.) plate or band iron.

EMMANUEL PERRY.

Detroit, Mich.

## FREEZING OF MOTOR BLOWS LINE FUSES

### Motor Located in Small Unheated Shed Was Found to Be Completely Covered with Snow—Motor Had to Be Baked

Where motors are installed out of doors they will usually generate sufficient heat to keep the oil of the bearings in working condition, but if the motor is not operated nearly continuously bad weather conditions may cause some trouble. This happened in one installation when a vertical motor was used for pumping out a large cesspool. When the fuses blew it was thought that the automatic starter was at fault, but inspection showed nothing wrong. The motor was located in an unheated shed, and it was found that all of the inclosure that was not taken up by the motor was full of snow, blown through the clearance between the walls of the house and its roof. It was impossible to turn the armature by means of a wrench applied to the coupling, and even had it been practicable to get the armature in motion it probably would not have been wise to place the motor in service, because the melting of the snow would have saturated the commutator and windings, with consequent damage. Accordingly the motor was removed and baked for a week in an oven before placing it in service that proved to be entirely satisfactory.

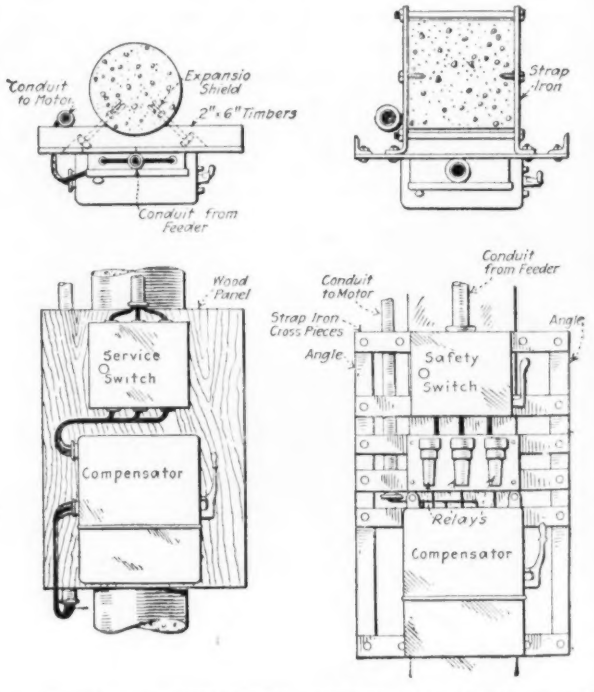
## MOUNTING MOTOR CONTROL ON BUILDING COLUMNS

### Two Methods, One Involving Wood Panels Fastened with Expansion Bolts, the Other a Steel Frame Held to Column by Clamps

On or around building columns is usually a good place to mount motor-control apparatus because the columns serve as supports without further obstructing traffic and are usually so distributed that a location which is convenient to the machine to be controlled can be selected.

In one plant, where round concrete columns are available, two 2-in. by 6-in. (5-cm. by 15-cm.) timbers are cut to fit the curvature of the columns and fastened thereto horizontally, one about 3 ft. (2.7 m.) above the other, by bolts and expansion shields. To these cross-pieces is attached a board panel on which an inclosed service switch and compensator are mounted. Conduit is employed between the main service panel, motor and these control panels, but is not run entirely to the switch and compensator housings, because it is desired to have the individual wires readily accessible for connecting split-type current transformers used in testing.

Other plants clamp the control panels to the columns. At one plant, for instance, where there are square col-




TWO METHODS OF SUPPORTING CONTROL PANELS ON COLUMNS

umns, each service switch, set of relays and compensator is mounted on a frame made of two upright angle-irons with strap-iron cross-pieces, the frame being attached to the column by two iron bars on each side, top and bottom. Each pair of bars is clamped together.

# CENTRAL STATION SERVICE

## A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

### HOME ECONOMY BUREAU IN LOUISVILLE SERVICE

**New Field Opened by the Commericial Department Will Help Housewives to Solve Domestic Problems and Save Labor**

A new field of activity has been opened for the commercial department of the Louisville Gas & Electric Company with the inauguration of its home-economy bureau. The innovation will be in charge of Miss Grace Otter, under the supervision of Robert Montgomery, manager of the commercial department, who is responsible for the idea. Miss Otter is a graduate of the Kentucky College at Danville, has completed a course in home economies. She has also qualified as a specialist in dietetics.

If a Louisville housewife finds herself confronted with a dinner or luncheon party and a lack of ideas as to the menu, table arrangements or the proper way to cook a dish, she need only telephone Miss Otter, who will lend every possible assistance to make the affair a success.

If a housewife is puzzling over the problem of relative food values with an eye to economy or health, if it is a problem of house management, a task of finding the simplest and easiest way of arranging the housework, or the quickest and best way to wash the clothes or iron them, to clean house or cook a meal, assistance will be forthcoming.

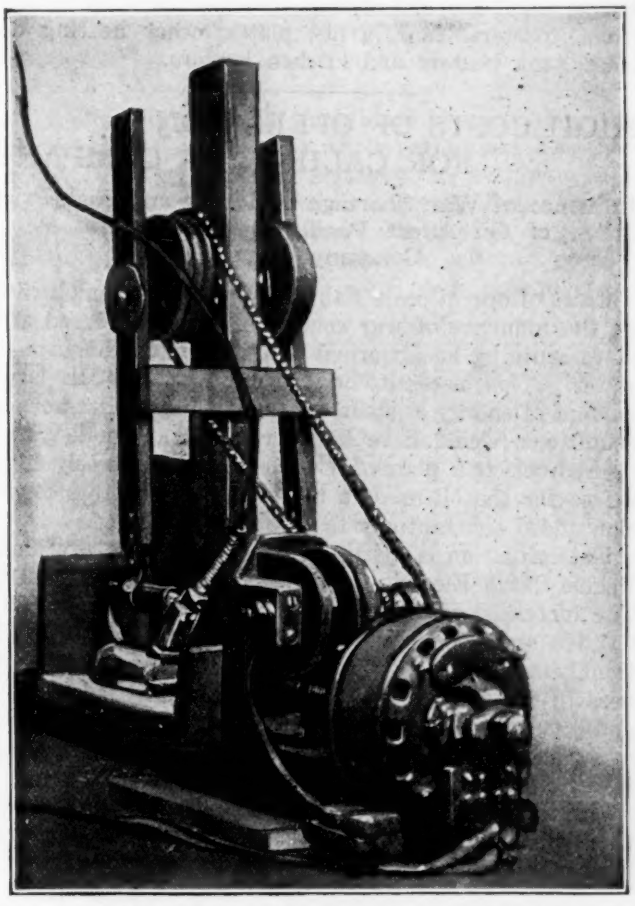
The new department will be fitted up with all the important electric and gas labor-saving appliances for demonstration purposes. A series of newspaper advertisements in the Louisville daily papers concerning the "new service" feature photographs of Miss Otter demonstrating various appliances, and invite requests for her new booklet, "Economy Helps for the Twentieth Century Housewife, with Tested Recipes." The booklet contains, besides menus and recipes, many suggestions for saving money, time and labor which are of no little value to housekeepers.

### DEVICE BUMPS IRONS TO TEST THEIR DURABILITY

**With Rated Current Flowing Iron Is Repeatedly Dropped on a Steel Plate Until Any Faults of Construction Are Disclosed**

A device to test the mechanical perfection of electric irons has been built by the esting department of the Commonwealth Edison Company, Chicago. The iron is connected to a regular 110-volt line by means of its cord, and it is then dropped repeatedly on a sheet of iron. This dropping is very much like the knocking that comes from setting down and taking up the iron in actual use.

The testing device is run by a 0.1-hp. motor. By means of a screw gear and chain and sprockets this motor drives a wooden wheel about 5 in. (13 cm.) in diameter at the rate of 30 r.p.m. The electric iron to be tested is clamped around the center of the handle to the lower end of a wooden bar 2 ft. (60 cm.) long, 3 in. (7.5 cm.) wide and ¾ in. (19 mm.) thick. This bar is raised by a pin in the rotating wheel which engages a shoulder of a slot in the bar. The bar and the iron are carried up until a stop disengages the bar and allows it to fall. The iron strikes on a piece of



IRON IS LIFTED AND DROPPED WHILE HOT

sheet steel. The machine is constructed with two sets of working parts so that two irons are tested at one time, one of the irons going up while the other is dropping.

The iron is tested in this manner until the heating elements, the plug or the plug socket show defects. The usual operation drops the iron from a height of 2 in. (7.5 cm.) about thirty times per minute. A very good iron will stand about sixteen hours to twenty-four hours of this severe treatment before it fails under the test.

## SALES OF MERCHANDISE TOTAL $2.50 PER CAPITA

### La Crosse Returns Include Gas Appliances—Data Show How Business Is Divided in City of 40,000 and Business of $100,000

Merchandise sales of the Wisconsin-Minnesota Light & Power Company, La Crosse, Wis., are expected to run fully $2.50 per capita in 1919. Sales have been keeping up to a rate which indicates a hundred-thousand year on a monthly basis, and since the last four months are always the best for merchandising, the company feels safe in predicting this total. The population of the city is 40,000. The company operates both gas and electric properties.

Division of the sales by Charles B. Yonts, manager of the company, shows the following percentages: House wiring, 16.6; gas ranges, 16.6; vacuum cleaners, 12.5; washing machines, 10; automatic gas heaters, 10; time and material jobs both gas and electric, 10. The remaining 14.3 per cent is made up of incandescent lamps, small gas and electric merchandise such as flat-irons, toasters, fans, grills, plates, other heating devices, tank heaters and kitchen heaters.

## HIGH COSTS OF OPERATION FOR CALIFORNIA COMPANY

### Influence of War, Shortage of Water and High Price of Oil Affect Pacific Gas & Electric Company Results

Costs of operation in California last year, complicated by the influence of war conditions, were rendered still more acute by an abnormal and state-wide shortage of water. This necessitated the production of a large amount of energy at steam stations which, under normal conditions, would have been produced at smaller cost at hydroelectric plants. Coupled with extremely high prices for the oil used in the steam plants, this condition added substantially to operating expenses.

This situation is discussed by F. G. Drum, president Pacific Gas & Electric Company, in his report for 1918. The increased costs in 1917 and 1918 amounted to $3,921,448 and practically absorbed every dollar of additional revenue derived from the greater volume of business in the two years and from the increased electric and gas rates during the latter half of 1918. In the meantime $6,390,889 of additional capital was invested in the business.

Excluding reserves for uncollectible accounts, casualties and depreciation, the cost of conducting the business in 1918 is segregated by Mr. Drum as follows:

| | |
|---|---|
| Oil used in gas manufacture and production of electricity by steam | $4,362,627 |
| Labor | 4,241,512 |
| Taxes | 1,782,939 |
| Energy purchased | 902,697 |
| Other expenses, chiefly materials and supplies other than oil | 1,404,554 |
| Total | $12,694,329 |

The table herewith presents in condensed form the trend of oil, labor and material costs representing substantially 79 per cent of operating and maintenance expenses from July, 1914, the month immediately preceding the outbreak of the European war, to December, 1918, the month following the signing of the armistice. During this interval oil prices increased 129 per cent, wages 32 per cent, taxes 140 per cent and materials and supplies 89 per cent. The prices in December, 1918, clearly indicate that the era of high costs did not cease with the armistics.

TREND OF COSTS FROM JULY, 1914, TO DECEMBER, 1918

| | Oil | | Operating Labor | | Materials and Supplies | |
|---|---|---|---|---|---|---|
| | Price per Bbl. Purchased (System Average) | Cumulative Increase, per Cent | Average Wages per Employee per Month | Cumulative Increase, per Cent | Index of Cost* | Cumulative Increase, per Cent |
| July, 1914 | $0.70 | .... | $90.16 | ... | $45,414 | ... |
| July, 1915 | .70 | .... | 90.67 | 1 | 49,175 | 8 |
| July, 1916 | .78 | 11 | 91.76 | 2 | 64,862 | 43 |
| July, 1917 | 1.14 | 63 | 96.9 | 8 | 78,981 | 74 |
| July, 1918 | 1.58 | 126 | 112.07 | 24 | 85,828 | 89 |
| Dec., 1918 | 1.60 | 129 | 119.07 | 32 | 85,862 | 89 |

* The figures in this column show that certain materials and supplies costing $45,414 in July, 1914, cost for like quantities of the same materials in July, 1916, $64,862, in July, 1917, $78,981, and so on until the maximum of $85,862 was reached in December, 1918. These are the costs of the company's average monthly quantity requirements of thirty-one kinds of materials most largey used in its business (excluding oil), as determined by actual purchases during three and one-half years.

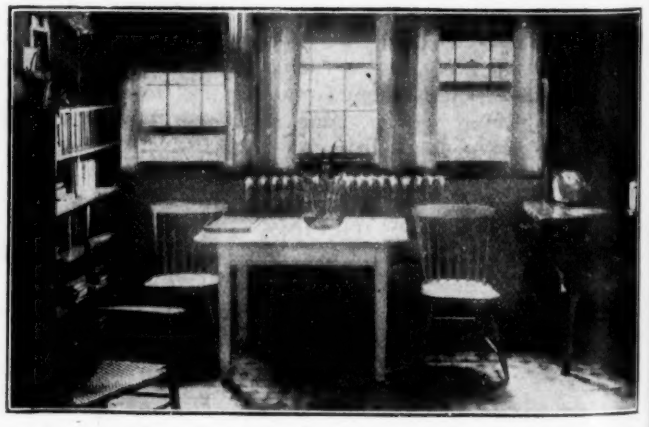
## WHY MORE MONEY SHOULD BE SPENT FOR NEW BUSINESS

### If Large Gain in Volume of Business Is Possible, a Portion of Increased Overhead Charges May Be Absorbed and Unit Costs Reduced

More money is being spent for operation of the new-business department and for advertising of the Indiana & Michigan Electric Company, South Bend, this year than ever before in its history, according to F. A. Bryan, president and general manager, who discussed the subject before the Indiana Electric Light Association.

Mr. Bryan said that by increasing the expenditure for securing new business he is able to enlarge the volume of the company's business and thus to absorb a part of the higher overhead expense. Through this practice he has been able to keep the unit cost of labor—that is, the cost of labor per kilowatt-hour produced—about the same over the past few years in spite of rising cost of labor. The increase in cost of coal and other commodities, however, has been such that it has not been possible to keep unit cost of production at its former level.

## The Labor-Saving Range



The electric range is a valuable adjunct in the kitchen of F. J. O. Alsop, Milton Mass., where work is scheduled on the basis of shift periods. In this residence the household employees do not live under the employer's roof, but go and come from their work at specified hours—a new departure in the employment of domestic help in the New England district. Other electrical conveniences lighten the labor of the establishment.

# CHARACTERISTICS AND EARNINGS OF RANGE LOAD

## Data from Two Communities in Michigan Show Possibilities of Using Small Transformers to Serve Large Residential Connected Load

To secure data on the characteristics of the electric cooking load the Detroit Edison Company made tests during the period from Dec. 25, 1918, to Jan. 2, 1919, on a group of five ranges that are connected to one 25-kw. transformer in one of the rural communities which it serves. In addition to the ranges, there are fifteen lighting circuits connected to the transformer, which load could not be separated from the cooking load. Range services are all taken directly off the transformer pole, and all of the connections are within two sections of the transformer. The tests were reported in a paper by R. F. Hotton before the recent convention of the Michigan Section, N. E. L. A.

The load was recorded on two Bristol recording ampere meters, one installed on each side of the neutral wire. The sum of the two readings at any time thus gives the total current output of the transformer at that time. The readings for the six days, Dec. 25, 26, 27, 29 and Jan 1 and 2, were selected, and the total load on the transformer for each hour of the day was obtained by adding the readings of the two meters. The curves shown were thus obtained, giving the characteristic average loads during the day and the maximum loads recorded during the period for each hour of the day, also the loads on the maximum day; that is, the day on which the total kilowatt-hours consumed was the greatest.

It will be seen that the curves have similar characteristics at all essential points. They all show well-defined peaks, as might be expected, indicating the time of breakfast preparation, morning baking, dinner preparation, afternoon baking, supper preparation, etc. The fact that there is considerable lighting load in addition to range load probably affects the shape of the curves somewhat—especially in the early morning and in the evening. Also the fact that most of the residences have some other appliances, such as vacuum cleaners, washing machines, etc., would affect the slope of the curve. Since the range load is large in comparison to the other devices, the curves may be considered fairly characteristic of range services.

It is interesting to notice how closely the curve for the maximum day follows that of maximum for the period, showing that for the most part the maximum for the period occurred on the maximum day. The average curve had most of the sharp peaks smoothed out, and since its shape agrees closely with that of both of the other curves, this is probably very nearly the typical variation throughout a day which might be expected under similar conditions, *i.e.*, range load combined with lighting and appliance load.

TABLE I—REVENUE FROM RANGE LOAD

| 1918, Month | Number of Consumers | Total Kw.-Hr. | Total Revenue | Average Net Bills |
|---|---|---|---|---|
| January | 119 | 12,161 | $346.64 | $2.91 |
| February | 127 | 11,325 | 323.44 | 2.54 |
| March | 128 | 10,957 | 317.04 | 2.31 |
| April | 128 | 15,117 | 412.80 | 3.22 |
| May | 133 | 16,397 | 467.31 | 3.55 |
| June | 148 | 19,862 | 543.77 | 3.67 |
| July | 178 | 29,747 | 807.24 | 4.53 |
| August | 195 | 32,665 | 889.08 | 4.55 |
| September | 204 | 31,305 | 856.65 | 4.19 |
| October | 202 | 23,882 | 659.19 | 3.26 |
| November | 202 | 22,002 | 611.18 | 3.02 |
| December | 201 | 18,669 | 513.88 | 2.55 |
| Total | 1965 | 244,089 | $6,743.22 | $40.30 |
| Average | 164 | 20,341 | $561.94 | $3.36 |

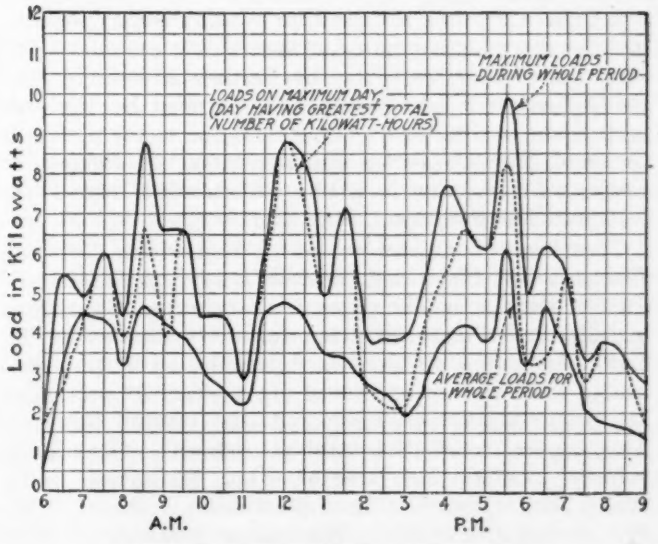
TABLE II—INSTALLATION AT HIGMAN PARK, BENTON HARBOR, MICH.

One General Electric 15-kva. transformer, greatest load as shown by recording ammeter 6 amp. at 2300 volts (about 13.8 kw.). Duration of peak load, ten minutes; duration of test, four days. Test made by Westinghouse recording ammeter. Connected load, twenty-five residences, one hotel, one pumping plant. The above all use lamps, and in addition there are connected:

| | Watts |
|---|---|
| One No. 50 Hughes range | 6,560 |
| One General Electric RI range | 5,200 |
| One No. 110 Rutenber range | 5,560 |
| One No. 406 Westinghouse range | 3,660 |
| One No. 319 Westinghouse range | 6,860 |
| One oven special range | 4,180 |
| One hot-plate special range | 3,300 |
| Total for ranges | 37,220 |
| One 2-hp. motor in pumping plant, pumping water for all above | 1,500 |
| Total for twenty-five cottages at 1000 watts each | 25,000 |
| Total installed load | 63,720 |

The diversity factor of such loads is also illustrated. The maximum load for the whole period was less than 10 kw. The transformer installed, 25 kw., was sufficient to care for all five ranges together, but owing to the diversity in use the actual load was never greater than 40 per cent. A 10-kw. transformer would do.

The figures continued in Table I were also given by Mr. Hotton to show the average net revenue from a varying number of range customers for the year 1918. The higher average during the summer months may be attributed to the summer homes, which are closed in September for the winter. Another reason is that some customers use coal or wood ranges in the kitchen during the cold months for heating as well as for cooking.




AVERAGE AND MAXIMUM RANGE LOADS

In discussing Mr. Hotton's paper, John Cavanaugh of Benton Harbor, Mich., presented data to show that the range customers on his system are served from transformers of ratings that in some places would be considered quite limited. Mr. Cavanaugh's data, in Table II, show that 63,720 watts of connected load is served from a 15-kw. transformer satisfactorily.

# DIGEST OF ELECTRICAL LITERATURE

## Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

### Generation, Transmission and Distribution

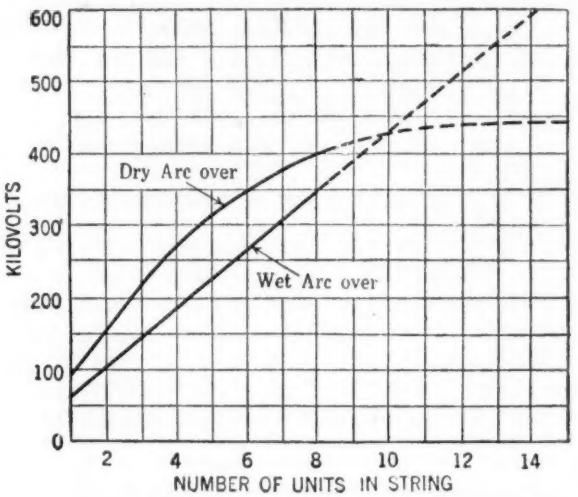
*Energy Stored in a Steam Boiler.*—FRED R. LOW.—The author has calculated the energy stored in steam per pound and per cubic foot for a series of boiler pressures up to 500 lb. absolute per square inch (35 kg. per sq.cm.). The data are given in tabular form.—*Power*, Sept. 2, 1919.

*The Devastated Factories of Northern France.*—AUGUSTE PAWLOSKI.—In continuation of a long series of views showing the destruction wrought in the French electrical industry by the invaders, four pages of illustrations are published, each showing the interior of an electric power house in the Meurthe-et-Moselle district before the war and under it a picture of the ruins that remain. "Fire and earthquake seem to have passed there!" exclaims the editor.—*Revue Générale de l'Electricité*, July 19, 1919.

*Utilization of Wasted Water Power.*—E. ADLER.—Most of the small mills driven by water power are in operation only about 2000 hours in the year and might be used during 6760 hours in the year to supply electric energy. This may be effected by installing induction generators that are used for feeding electric energy into the distributing mains of the electric systems. The adoption of this plan has the further advantage that the induction machine may also be used by the mill proprietor as a motor to supplement the water power in times of stress.—*Technical Supplement to Review of Foreign Press*, Aug. 5, 1919. (Abstracted from *Elektrot. und Maschinenbau*, May 25, 1919.)

*The Typical Operation of a Generating Station, Transmission Lines and Outdoor Receiving Stations.*—FRANK HOWARD.—The paper is descriptive of a typical installation. Plans are given for the operation of the main generating station, the transmission system connected to it and an outline of the method of procedure at the principal receiving and distributing stations. The general conditions are as follows: Generating voltage, 11,000 volts; size of main generating units, 30,000 kva.; distributing transmission voltages, 130,000, 66,000 and 25,000. The author proceeds to show how such a system should be operated to the best advantage as a whole. He states that in the past, although every refinement has been made in the generating station for economical operation, the transmission and distributing system has not had this same attention and that improvements in transmission lines, design and operation should receive the closest attention.—*Ohio Electric Light Association Monthly*, August, 1919.

*California 200,000-Volt Transmission Bus.*—R. W. SORENSON, H. H. COX and G. E. ARMSTRONG.—In this paper the writers call attention to the urgency of interconnecting the large California systems to form one great transmission bus 1200 miles (1900 km.) long for carrying 1,500,000 kw. This would permit large interchange of energy between the various companies operating the California systems and would greatly relieve the drain on the oil supply, which, the authors say, should be set aside for the use of ocean-going and air-going craft. As pointed out in a recent paper by A. E. Silver, there appears to be no engineering obstacle to the operation of transmission systems at 220,000 volts. Moreover, the experience with the Big Creek transmission systems operating at 150,000 volts, over a period of five years, indicates that the time is at hand for raising the California systems to the new voltage of 220 kv. One obstacle to the interconnection plan is the fact that the Southern California Edison Company operates at a frequency of 50 cycles. It is pointed out, however, that the advantage of conforming with the A. I. E. E. standard of 60 cycles is generally appreciated and should result in the change from 50 cycles to 60 cycles




ARC-OVER VOLTAGES FOR SUSPENSION INSULATOR STRINGS

on this system. With the conductor spacing proposed the system would operate just at the critical corona voltage, and the authors state that any abnormal voltages should be damped out by the corona discharge. As shown in the accompanying curve, there is not much advantage in using more than ten units in the insulator strings since the dry arc-over voltage increases very little beyond ten units. It is proposed to operate the 220-kv. line with eleven insulators in the string. A table shows characteristics of the present 150-kv. Big Creek lines and those for a 220-kv. line as proposed by Silver. A series of charts are also given by the writers to show the necessity of using synchronous condensers on these high-voltage lines.—*Proceedings A. I. E. E.*, September, 1919.

*Maintenance of Air-Blast Transformers.*—It is said that maintenance in the service of the United Railways of St. Louis is confined to rebuilding because of burnouts and to bi-weekly cleaning. A new design of cover is used for fire prevention.—*Electric Railway Journal*, Aug. 30, 1919.

## Installations, Systems and Appliances

*Electric Welding: Its Theory, Practice, Application and Economics.*—H. S. MARQUAND.—In this number of the series the author concludes his description of methods of preparing welds and gives some further illustrations of various kinds of work that are now undertaken. He enters upon a discussion of the economies effected by machine welding and of the testing and strength of electric welds.—London *Electrician*, Aug. 22, 1919.

*Electrification of a Three-High Merchant Rolling Mill.*—The mill is provided with a tilting table for elevating the plates up to the higher pair of rolls. With such a non-reversing mill a flywheel with a large amount of stored energy can be used, so that a smaller motor is required than with an Ilger set, and in addition the efficiency is higher. The motor in this case is a 3000-hp. Witton motor and is designed for running on a 2400-volt, 60-cycle, three-phase circuit at a normal speed of 514 r.p.m. The guaranteed efficiency of the motor is 95 per cent at full load, 94.5 per cent at three-quarters load and 93 per cent at half load. At the same loads the power factors are 85 per cent, 90 per cent and 70 per cent respectively. The overload capacity is not less than 25 per cent for two hours without undue heating, and the machine will stand an overload of 100 per cent for short periods without injury or damage.—London *Electricity*, Aug. 15, 1919.

*Cables for High-Voltage Alternating Current.*—According to W. Kummer of Zurich, the prejudice in favor of the use of overhead lines for the transmission of high-voltage current is beginning to weaken and the advantages of underground transmission to become better appreciated. In considering the problem there are two points to which special attention should be directed: (1) the potential difference between the two extremities of the conductors both when unloaded and when fully loaded; (2) the current passing when the conductors are not loaded. He proceeds to discuss both these conditions mathematically. Subsequently the author accepts Dr. Humann's assumption that the external diameter of a cable for underground work should not exceed 100 mm. diameter over the insulation and a pressure of 5000 volts on the inner millimeter for the insulation between the copper conductor and the external lead covering of the cable. The results for different diameters of the copper conductors are plotted in the form of curves, one of which refers to single-conductor cables and the other to cables with three conductors in one cable. The highest absolute difference of potential between the conductor and the earth of 92,000 volts is given with a single-conductor cable where the copper is 36 mm. in diameter and the insulation has a radial thickness of 32 mm. With the zero point of the transformers earthed, such a cable would safely carry either single-phase current at 184,000 volts or polyphase at 159,000 volts and a current of 800 amp.—*Techincal Supplement to Review of Foreign Press*, July 22, 1919. (Abstracted from *Schweiz. Bauzeitung*, May 10, 1919.)

## Electrophysics and Magnetism

*Electromagnetic Waves.*—T. J. BROMWICH.—This paper contains a general solution of the electromagnetic equations of wave propagation. The formulas are expressed in terms of general orthogonal coördinates as well as for spherical polar coördinates. Various specific conditions are discussed as well as the equations offered by other authors.—*Philosophical Magazine*, July, 1919.

*Oscillations During the Discharge of an Induction Coil.*—E. TAYLOR JONES.—The writer describes experiments for the purpose of measuring small currents at high voltage and frequency, such as may occur in the discharge of X-ray tubes.—London *Electrician*, Aug. 22, 1919.

*Thermionic and Photo-Electric Phenomena at the Lowest Attainable Pressure.*—The pressures attained were as low as $3.5 \times 10^{-7}$ mm. of mercury. Upon denuding a tungsten plate of its occluded gases by raising it to a bright yellow heat by electronic bombardment, the photo-current rose to many times the value obtained before such denuding, and further heating produced no further change. The upper wave-length limit of tungsten was observed to be in the region 2100 and 2300 *A*. According to Einstein's equation, the corresponding values of the work necessary to free an electron from the metal would then be between 5.7 and 6.3 volts. These are larger than the corresponding values in the case of thermionic emission. A gradually increasing potential difference was applied between the tungsten plate and a glowing filament until the blue haze appeared. No pressure change whatever was observable at the moment of its appearance.—*Physical Review*, June, 1919.

*Study of Industrial Dielectrics.*—RAYMOND BOUZON.—The first part of this article is devoted to the definition of the specific qualities of insulators, the description of the apparatus used to test them, their standardization and their mounting in preparation for use. As preliminary to the question of the measurement of losses in the dielectrics under alternating current, the author discusses some general questions of great interest concerning losses by hysteresis, bringing out the differences in the shapes of the curves derived respectively when the surroundings are perfectly elastic, entirely viscous, slightly elastic and elastic in high degree. In the second part of the article he describes the apparatus and the methods which he has used to measure dielectric losses under alternating current and to measure the specific inductive capacity. Some of the methods described are held to be entirely new and very ingenious.—*Revue Générale de l'Electricité*, Aug. 2 and 9, 1919.

*Inherent Limitations on Transformations Possible by Stationary Apparatus.*—JOSEPH SLEPIAN.—Expressions for electrostatic and electromagnetic energies, Joulean heat dissipation and power are given in complex quantities. The purely imaginary part of the expression for power in a static network is shown to be equal to $2\omega$ times the difference between the mean electromagnetic energy and mean electrostatic energy. Use is made of this new principle in considering the problems of power-factor correction and phase splitting. It is shown that in general for that phase transformation by static apparatus both magnetic and electrostatic storage of energy are necessary, and it is shown how the minimum amounts of each are determined by the load. The symmetry of the coefficients in the general equations for the steady state in a static network is demonstrated, and it is shown that limitations upon voltage and current transformations follow. The voltage regulation of any phase-splitting arrangement is considered.—*Proceedings A. I. E. E.*, September, 1919.

### Units, Measurements and Instruments

*New Forms of Instruments Showing the Amount of Combustible Gas in Air.*—E. R. Weaver and E. E. Weibel.—This paper contains a description of the experimental work on the combustion of gas at the surface of an electrically heated wire and the application of this phenomenon to the design of instruments for detecting the presence or indicating the amount of combustible gas in the air.—*Bulletin No. 334, Bureau of Standards,* June 23, 1919.

*Recording Instruments with Rectangular Coördinates.*—Most of the recording instruments in present use give records with ordinates lying on arcs of circles, which renders the evaluation of the records by plani meters and other methods a lengthy process. The firm of S. Guggenheimer, Nurnberg, has developed instruments with rectangular coördinates. Instruments for direct and alternating currents are described and illustrated.—*Technical Supplement to Review of Foreign Press,* Aug. 5, 1919. (Abstracted from *Elektrot. Zeits.,* June 5, 1919.)

*Determination of Luminous Flux.*—R. Dispenza.—The different existing methods, such as those of Zeidler, Blondel and others, for determining the luminous flux are of long and delicate application. That of Block is speedy but often leads to important errors. The method devised by the author and described in the present article lays claim both to exactitude of results and rapidity of application. It is founded both upon the Rousseau diagram of lighting and upon a peculiar manner of calculating the luminous flux. The author shows that it is possible to work out in polar coördinates the diagram corresponding to the Rousseau diagram.—*Science Abstracts, Section B,* June, 1919. (Abstracted from *Elettrotecnica,* March 25 and April 5, 1919.)

*The British Scientific Products Exhibition.*—Among the new devices exhibited was an electrical resistance thermometer which has rapidly come into use as a means of temperature measurements between —200 deg. C. and 540 deg. C. The thermometer is a resistance instrument, and its coil forms one arm of a Wheatstone bridge. The three other arms are made of a material which has practically zero temperature coefficient. The bridge is balanced at the commencing temperature of the scale. Any alteration in the temperature deflects the galvonometers, robust double-pivoted instruments with dustproof metal cases having scales 7 in. (17.8 cm.) long and fitted with a mirror to avoid parallax errors. The indicators are mounted on slate switchboards with plug switches, to which the various thermometers are wired. Any thermometer in the circuit is connected by inserting the plugs. For permanent records the instruments are coupled with thread recorders in which the pointer is automatically depressed every minute or half minute. The thermometer itself consists of a coil of platinum wire wound on a porcelain spool which is usually 50 mm. long and 11 mm. in diameter.—London *Engineering,* July 18, 1919.

### Telegraphy, Telephony and Signals

*A System of Railway Traffic Control by Telephone.*—T. F. Lee.—The paper has special reference to the control of freight trains by means of telephone communications. Generally the control is arranged for some form of call whereby one telephone in a certain section can ring up another either by code or, preferably, by a collective system, without disturbing the remaining telephones on the line.—*Post Office Electrical Engineers' Journal,* July, 1919.

*The Marconi Direction Finder.*—The standard Marconi direction-finder installation comprises the following parts: (1) A special aërial system; (2) a direction finder; (3) a special transformer; (4) the detector. These parts are described and illustrated in this article. —London *Electrician,* Aug. 8, 1919.

*The Receiving Loop (or Frame).*—W. Burstyn.—Following the method adopted in a former article dealing with the Marconi antenna, the author studies the dependence of the intensity of reception upon the sharpness of tuning, the dimensions of the loop and the wave length for the case both of undamped and damped oscillations. In both cases the intensity of reception is, within wide limits, independent of the sharpness of tuning and for small loops is about proportional to the third power of the linear dimensions of the frame. The intensity of reception for undamped waves diminishes, however, more rapidly than in a Marconi antenna when the wave length increases, while for damped waves an optimum wave length is demonstrated to exist, the value of which depends upon the damping of the loop.—*Science Abstracts, Section B,* June, 1919. (Abstracted from *Jahrb. d. Drahtl. Tele.,* January, 1919.)

### Miscellaneous

*Separation of Costs in a Combined Steam Heating and Electric Plant.*—H. W. Meyer.—The writer describes a method for separating the coal costs chargeable to the electric from those of the steam-heating department. All other boiler-room costs are divided between these departments in the same proportion as the coal costs.—*Power,* Sept. 2, 1919.

*The Flash and Burning Points of Gasoline-Kerosene Mixtures.*—J. T. Robson and James R. Withrow.—In this article are given the effects of gasoline content on the flash and burning points of kerosene, also the flash and burning points of kerosene mixed with low-test gasoline, high-test gasoline and petroleum ether.—*Chemical and Metallurgical Engineering,* Sept. 1, 1919. (Abstracted from paper read before the American Institute of Chemical Engineers, June 20, 1919.)

*Physical and Chemical Tests on Commercial Marbles.*—D. W. Kessler.—A study of the properties of the different deposits of stone is important in order to determine their regular value for use in commerce and the arts. The relation between the physical properties of stone and its serviceability is not well understood. This investigation is the first step in an extensive program to establish more definitely by laboratory methods the relative value of different deposits of stone for building purposes.—*Technical Paper No. 123,* Bureau of Standards, July 15, 1919.

*The Coal Resources and Transportation Facilities in Alaska.*—F. P. Coffin.—The Alaskan coal fields contain the only accessible deposits of high-grade semi-bituminous coal on the shores of the Pacific Ocean, as well as extensive deposits of lignite. Their development has been held back by unsatisfactory land laws and by the lack of railways. Congress has passed new laws, and transportation facilities are now available. The coal-mining industry is being developed to supply fuel for local requirements. If coal can be produced economically, it can ultimately be shipped to supply the Pacific Coast market.—*General Electric Review,* July, 1919.

# NEWS OF THE INDUSTRY

## Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

### AMERICAN DELEGATES TO I. E. C. MEETING IN LONDON

**Plenary Meeting to Be Held in England, Beginning Oct. 20—American Delegates Are Messrs. Mailloux, Burke, Hobart and Chubb**

American delegates to the plenary meeting of the International Electrochemical Commission to be held in London beginning on Oct. 20 will sail early in October. The representatives of the American Institute of Electrical Engineers will be Dr. C. O. Mailloux, James Burke, H. M. Hobart and H. E. Chubb. Messrs Mailloux, Chubb and Hobart leave Oct. 8, and Mr. Burke sailed Oct. 4.

C. le Maistre, secretary of the British Engineering Standards association, who has spent the last six weeks in this country and Canada and has been in close association with the American engineering standardization movement sailed for England on Sept. 30.

### "A. I. E. E. PLANS MUST CONSIDER THE FUTURE"

**President Clavert Townley, Addressing the St. Louis Section, Says That Preparations Must Be Made for Still Greater Membership**

"Any new plans made now by the board of directors of the American Institute of Electrical Engineers must consider the future, when the organization will be much larger than it is to-day," said President Calvert Townley in an address on Institute matters to the St. Louis Section on Wednesday evening, Sept. 24. The electrical industry doubles in size every five years, and the Institute has also grown quite rapidly in its thirty-five years of life. Its membership grew to 1250 in the first seventeen years, but it added about seven and one-half times as many members to its roster during the second half of its existence. We must therefore prepare now for the still greater membership to be expected in years to come. The American Institute of Electrical Engineers is a pure democracy. Every member has the right to express his opinions, and the wishes of the majority always govern. No member need feel diffident about making his ideas known at Institute headquarters.

"The board of directors hear too seldom rather than too often from the membership at large, and in connection with the president's letter of Aug. 19 to the Institute membership on the report of the committee on development all should send in their views, even though others may have expressed similar views before."

Past-president Paul M. Lincoln complimented the St. Louis Section on its coöperative working arrangement with other local engineering organizations and said that a similar spirit of coöperation was necessary in finding a solution for the present problems of the Institute at large.

H. W. Eales, St. Louis, member of the committee on development, described the work and objects of the committee. H. H. Humphrey, G. A. Waters, J. L. Woodress and A. McR. Harrelson were among others who entered into the discussion. Chairman J. L. Hamilton of the St. Louis Section presided.

### N. E. L. A. COMMITTEES ARE ORGANIZED IN CHICAGO

**Work Is Planned by Overhead Systems Committee and Inductive Interference Committee for the Ensuing Year**

On Sept. 23 and 24 two committees of the National Electric Light Association held organization meetings at Chicago. These were the overhead systems committee, of which W. K. Vanderpool, Public Service Company of New Jersey, Newark, N. J., is chairman, and the inductive interference committee, of which A. E. Silver of the Electric Bond & Share Company of New York is chairman. For the overhead systems committee sub-committees on insulators, joint construction, line construction and maintenance were appointed. It is planned that a questionnaire to bring information on these topics shall be sent to member companies in the near future.

It is the purpose of the committee to study the inductive interference situation and its relation to practices of the power industry. The discussions brought out clearly the increasing seriousness of this situation, due primarily to the rapid multiplying of the circuits of all parties concerned, to the ever-increasing susceptibility of telephone circuits attendant upon new advances in the telephone art and to the lack of understanding of generally satisfactory methods of controlling the disturbing effects.

Plans were developed for organizing and inaugurating the committee's work, in pursuance of which two sub-committees were appointed, one for the purpose of collecting general data pertinent to the subject and the other for studying the problems now being encountered.

The efforts of the former sub-committee, of which S. G. Rhodes is chairman, will include the gathering and analyzing of all available data of actual cases of inductive interference, with descriptions in detail of the causes, nature and extent of disturbance, measures of relief applied, allocation of expense involved and other conditions. Any company that has experienced troubles of this character can lend effective support to the committee by mailing information to W. C. Anderson, technical secretary National Electric Light Association, 29 West Thirty-ninth street, New York City.

The latter sub-committee, of which H. B. Gear is chairman, will work toward building up a centralized agency for assisting power and lighting companies to arrive at sound and proper solutions of their inductive interference problems and for effecting a closer coöperation in matters of this nature.

## PEACE TREATY BEFORE THE WATER-POWER BILL

### Consideration of Measure in the Senate Will Be Put Off Until After Action Is Taken on International Matters

Consideration of the water-power bill in the Senate must await ratification of the peace treaty. Senator Jones of Washington, chairman of the committee on commerce, who is in charge of the bill, made a strenuous effort to secure permission to consider the measure during such times as the peace treaty might not actually be before the Senate. This was defeated by Senator Lenroot, who declared he would fight any plan to take up the water-power bill before disposing of the treaty. Senator Jones gave notice, however, that he would call up the water-power bill immediately following ratification of the treaty and would attempt to keep it constantly before the Senate until voted upon. He fully expects to be able to secure a vote on the bill before the end of the extra session.

An amendment to the water-power bill by Senator Knox of Pennsylvania provides that no contract for power, light, heat or water, or for their delivery from any projected works, shall be affected by any license under the act and that no one is to be released from any such lawful obligation by reason of the water-power act.

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## ANALYSIS OF GROWING DEMAND FOR ELECTRICAL APPLIANCES

### A. E. Loeb Discusses Popularity of Different Appliances and Explains Reasons for the Recent Growth of Sales

The growing demand for electrical appliances and the factors which created this demand were subjects discussed by A. E. Loeb, vice-president of the Avery & Loeb Electric Company, Columbus, Ohio, at a meeting of the central division of the Electrical Supply Jobbers' Association in Chicago on Sept. 15. The substance of the paper follows:

Electrical appliances have practically become necessities. The demand for all lines is larger than ever before and moreover is steadily increasing. In the washing-machine field factories are doubling and trebling their outputs by putting in more equipment, more buildings and otherwise straining every effort to keep up with the demand. It is said that there will be three times as many washing machines sold in 1920 as in 1919. The same story is true of the vacuum cleaner. Orders placed for 100 machines usually bring a partial shipment of twenty-five. Portable electric sewing machines are not so popular as they should be, probably owing to the fact that they should be sold by real sewing-machine salesmen. There are more than 1,000,000 tread machines sold annually in the United States, and a good percentage of this should be converted to portable electrics, sold through electrical dealers.

In the heating appliance department ranges, flatirons, toasters, heating pads and lamp-socket radiators are the five leaders. One factory reports that in two weeks alone it sold more than 700 ranges. The lamp-socket radiator, which proved to be such a popular seller last year, is coming back this year stronger than ever. The demand for the washer has led up to a big field for the electric ironer. While the household refrigerating plant is new, several manufacturers have developed reliable machines and will open a large field which has been scarcely scratched. In this same class might be cataloged the dishwasher.

Among the reasons for this enormous demand a big factor has been the educational and development work that has been going on for the past five to ten years. Printer's ink has been freely used in national and local advertising. Electrical shows have added considerable strength to the propaganda, and the development of the appliances themselves have assured the public that the merchandise was worthy and would do the work intended. The time-payment plan has made the way easier to place the article in the customer's home. Demonstrations in the home convinced the housewife that the appliance would do the work. The servant-girl problem has helped to stimulate the field to a very large extent. The majority of the 12,000,000 women who went into industrial work during the war have not again returned to domestic work. Immigration has stopped and workers are leaving this country.

The wide field for electric appliances is shown by the fact that there are now 7,000,000 homes wired for electricity. The majority of the people living in these homes can afford to pay for appliances, especially on the time-payment plan. In addition, old homes are being wired each year. Just a word here in connection with the rewiring of old houses and wiring of new ones. Too much stress cannot be laid on the fact that houses in many cases are not properly equipped with plugs and outlets.

How much of this business is going through the jobbers' hands? There has been complaint of the poor profits on washing machines on account of the manufacturers selling direct to dealers at a high discount. This may be a result of the small effort on the jobber's side to impress himself sufficiently on the manufacturer. Again, some of the central-station companies which discontinued the sale of appliances have taken them up aagin. The reason is probably that no dealer in their community has properly pushed this line. Are the jobbers awake to the possibilities of this new angle of merchandising?

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## LARGE NEW HYDROELECTRIC DEVELOPMENT IN THE SOUTH

### Recently Organized Transmission Company Purposes To Build Two Water Plants, One In Georgia and the Other in Alabama

The Georgia-Alabama Power Company, organized early this year, has awarded contracts for the building of two water-power plants that will serve southwestern Georgia and southeastern Alabama. One of these plants, which will operate under 24-ft. (7.2-m.) head, is situated on the Flint River near Albany, Ga., and will have a rating of 2750 hp. Wellman-Seaver-Morgan waterwheels and General Electric generators will be installed. The other station is at Pataula, Ala. It will operate under 35-ft. (10.5-m.) head and have a rating of 2500 hp. General Electric generators will be installed. The waterwheel contract has not been awarded. Both stations will have auxiliary steam plants.

The company has purchased the property of the Albany Power & Manufacturing Company at Albany, Ga., and owns two small water powers at Columbia, Ala. Energy will be transmitted to Dothan, Enterprise, Eu-

faula and Headland, Ala. In Georgia a transmission line is being built from Albany to Pellam, about 35 miles. Investigations have shown that the probable annual output will be 43,000,000 kw.-hr. for the two stations, consisting of a twenty-four industrial load at 65 per cent load factor. Mees & Mees of Charlotte, N. C., are consulting engineers, and the Hardaway Contracting Company is the contractor for the station. Dermot Shemwell is president of the new company.

## STANDARDIZATION AS AN AID TO THE PEACE OF THE WORLD

### Charles Le Maistre, of British Engineering Standasds Association, Says Standardization Is 15 per Cent Technical and 85 per Cent Human

At a dinner given in honor of Charles Le Maistre, secretary of the British Engineering Standards Association, by the American Engineering Standards Committee the guest of the evening expressed the opinion that one of the strongest ties which can bind two or more nations together is engineering and industrial standardization.

This, the first affair of the kind to be given by the American Engineering Standards Committee, took place at the Engineers' Club, New York, on the evening of Sept. 18. It was attended by more than fifty engineers, representing practically every organization interested in the development of standards.

Responding to the invitation of Chairman Comfort A. Adams, who acted as toastmaster, Mr. Le Maistre said in part:

"Human language is a very poor interpreter of the highest thoughts of the human mind, and I must plead with you and ask your indulgence as I can be but a poor interpreter of the very high ideals which the British Engineering Standards Association has always set before it. The B. E. S. A. was formed in 1901 at the instance of Sir John Wolfe Barry, the doyen of our engineering profession, and it was through his able guidance during some sixteen years of the most important period of its existence that the association gradually gained the confidence of the people. We are now an organization of some 300 committees and 1200 members who give their time fully to the work.

"Though much of the work of our committees is done in London, many of them meet in the centers where the particular standard under discussion is manufactured. This assures at the very outset that those people who are going to use the standards and who are in daily contact with the apparatus involved, and who have the closest knowledge of the details, shall put up the first proposals. This is not quite what we used to do, but we realize more and more that standardization is—shall I say?—15 per cent technical and 85 per cent human. Standardization is an industrial matter and it is the industry that should put up the standards and get the help of the engineers and experts to support them.

"I hardly like to go into a discussion of the general principles of standardization because I should feel that I was talking to my masters. However, we agree that standardization means efficient production. It can be effective only when overlapping is avoided. Overlapping can be obviated only by the operation of some central organization, which we have provided in Great Britain with wonderful effect. We find now that overlapping of effort is becoming less and less each year and the B. E. S. A. is becoming more and more recognized as the central authority for drawing up standards for the engineering and allied industries.

"During the last year or two I have received at my office numbers of letters from America inviting coöperation, and I have always been in some difficulty to know how to reply. Take, for instance, the electrical industry, which has in this country at least a dozen organizations doing standardizing work. A request from one of those could not be accepted as from all. My association feels that, at the present important stage of the development of the work and of the closer relationship with the United States, if only we could get coördination of standardization on both sides of the water, one central authority on each side, it would not only help our industries enormously, but we could work hand in hand on these technical problems which involve this complicated human factor. And in doing this big work we would surely be no mean influence in promoting the peace of the world."

Following Mr. Le Maistre's address Chairman Adams called for responses from the representatives present. Dr. C. O. Mailloux spoke as the chairman of the American committee of the International Electrotechnical Commission and as a close friend and admirer of Mr. Le Maistre. Nelson P. Lewis, past-president and representative of the American Society of Civil Engineers, pledged the support of his society for the contemplated development of the American committee. Prof. Charles F. Scott reviewed the beginnings of electrical standardization in America, which he regarded as the basis of international electrical standardization accomplished so far. Edwin M. Herr represented the American Society of Mechanical Engineers and also spoke for this society. Guilliaem Aersten of the American Society for Testing Materials introduced a pleasing analogy to emphasize the necessity for developing team work, which helps not only the team but the individual as well.

Dr. S. W. Stratton, director of the Bureau of Standards, reiterated the readiness of the government departments to coöperate in the development of the committee's program, and Charles M. Manly, president of the Society of Automotive Engineers, pledged his society. Ira H. Woolson represented the National Board of Fire Underwriters, A. Cressy Morrison spoke for the National Safety Council, G. H. Ramsdell told of the standardization work of the American Gas Association, B. F. Waterman represented the American Gear Manufacturers' Association, Charles W. Baker spoke for the technical press, and D. Knickerbacker Boyd told of the great need of standardization in building materials and design.

Other engineers present included Bernard A. Behrend, James Burke, William J. Baldwin, George M. Bond, William E. Bullock, J. V. M. Dorr, William A. Del Mar, Gano Dunn, F. G. Diffin, R. J. Durley, George Fuller, Stanley G. Flagg, Jr., Alfred W. Gibbs, Charles W. Hunt, John Hunter, F. C. Hanker, Henry M. Hobart, James F. Hunter, David S. Jacobus, D. C. Jackson, Arthur E. Kennelly, Harry N. Latey, Clifford B. Le Page, Fred J. Miller, Lyman P. Morehouse, Casin W. Obert, Farley Osgood, George H. Pegram, Dana Pierce, Calvin W. Rice, J. Waldo Smith, Charles E. Skinner, A. Bessey Smith, John B. Taylor, William K. Vanderpoel, C. L. Warwick and C. M. Young.

## WINDSOR POWER HOUSE ONCE MORE ENLARGED

### An Additional 30,000-Kw. Unit Just Put in Operation Will Furnish Energy to the Goodrich Rubber Company in Akron, Ohio

The American Gas & Electric Company has just placed in service at the Windsor plant on the Ohio River north of Wheeling an additional 30,000-kw. turbo-generator, bringing the total installation at this plant up to 120,000 kw. This unit, known as No. 5, is the third of this rating installed by the American Gas & Electric Company at the Windsor plant, the West Penn Power Company having also one similar unit, No. 2.

This increase in capacity has been necessitated by the rapidly growing industrial load of eastern Ohio. The Northern Ohio Traction & Light Company, the operating company in Akron, and the Central Power Company, the operating subsidiary of the American Gas & Electric Company in eastern Ohio, have entered into an arrangement by which the Akron Company will obtain power from Windsor over the main transmission line to Canton and then to Akron. It is understood that the contract calls for the delivery of about 25,000 kw. of additional energy in Akron. With the new unit in service, this load will be taken on at once.

Construction of the Windsor plant was begun in the latter part of 1916, as a joint project of the American Gas & Electric Company and the West Penn Power Company. The West Penn Power Company has not increased its original installation. Instead, it has recently awarded a contract for the construction of a new station at Springdale, on the Allegheny River, northeast of Pittsburgh, to have an initial installation of 40,000 kw.

## SEATTLE COMMITTED TO THE SKAGIT RIVER DEVELOPMENT

### Northwestern City Decides to Appropriate $420,000 for Building a Road to New Power Site and Will Go Ahead with Construction Plans

Seattle has finally decided by ordinance to appropriate $420,000 for building a road to the Skagit River power site and for the construction of a sawmill and a hydroelectric plant to supply energy for building the first unit of 36,,000 kw. The site is in solid rock. The reservoir of 500,000 acre-feet (615,000 cu.m.) will also be all in solid rock. The total project will admit of 250,000 hp. continuous power in average years. The city is now increasing its 20,000-kw. steam plant to 35,000 kw. The city also receives 10,000 kw. from its Cedar River 60,000-volt plant. Seattle is growing so fast that more power is urgently needed.

The city's fuel oil bill for 1920 will be $800,000, so that it is desirable to eliminate this cost by hydroelectric power as soon as possible. As 35,000 kw. in steam will be made idle by the first Skagit unit and this steam will be available for some time in case of accident, it is considered safe to use one large 45,000-kva. machine instead of two of half the size. The first power plant, known as the Gorge Creek plant, will contain five or possibly six of these machines eventually, assuming a load factor of 50 per cent. All machines are desired to be of the same size.

A unit system has been designed by J. D. Ross, superintendent of Seattle's light and power system, working in conjunction with his engineer of inside construction, W. J. McKeen, in which the generator and transformers are considered as a unit. There will be no busbars or switches between the 45,000-kva. generator and transformers, the two being connected solidly through reactance coils. This settles the difficulty of making suitable low-voltage switches for such large loads and reduces the switchboard to a fraction of the ordinary kind. The operating is vastly simplified, the first cost is greatly reduced, and the cost of maintenance, repair and depreciation is also greatly reduced. The Seattle system has been in operation for fifteen years and has never lost a main transformer in service in its hydroelectric plant, while there were a number of shutdowns due to troubles on busbars and switches.

All switching will be done on the high-tension buses. From these the power will be carried to Seattle, 100 miles (160 km.) distant, at 160,000 volts.

Plans and specifications for the power plant and transmission line are now finished. The site of the impounding dam has been drilled, and the foundation proves to be excellent. The foundations of the diverting dam at the Gorge Creek plant are being drilled at present.

For the first machine and line $5,500,000 bonds have been authorized and $1,500,000 sold.

## PROBLEMS BEFORE THE N. E. L. A. MEMBERSHIP

### President Ballard, Writing to President Gille of the Northwest Association, Discussed Some of the Questions Receiving Attention

In a letter to H. J. Gille, president of the Northwest Electric Light & Power Association, President R. H. Ballard of the National Electric Light Association expressed keen regret at his inability to be present at the recent convention of that association. The date of the meeting conflicted with his agreement to attend the conventions of the Southeastern and New England Sections.

Mr. Ballard wrote Mr. Gille in regard to some of the great problems before the industry. He said in part:

One of the big conservation measures is the development and use of water power, thus serving the double purpose of securing an additional and inexhaustible supply of electric energy for new industries and releasing for other purposes an exhaustible supply of fuel.

Another conservation measure which will come more gradually is the partial electrification of steam railroads, especially over mountain passes. Our central stations must be prepared for this when it comes, in order that the best economy may be attained by combining the electrical demands of the railroads with the regular commercial demands of central stations, thus securing the maximum benefits of diversity and putting the generating stations to their greatest use during all hours of the day. A strong committee is being organized to deal with this subject.

Interconnections of transmission systems traversing large areas, irrespective of political subdivisions, cities or even counties, has demonstrated the fallacy of municipal ownership of electric systems with their lines confined to single municipal areas. It is this broad distribution and these conditions of diversity which make possible the substantially lower average rates to consumers from large privately owned systems and in a measure account for the development and use of electric energy from privately owned systems being some twenty times that consumed from municipally owned systems in our country.

With the regulation of electric utility rates to provide only sufficient return on capital investment to attract new capital to meet the constant demands for expansion and

development, and with a courageous attitude on the part of state regulating bodies to see that such reasonable return is allowed to utility companies, the electric industry is free from politics and may devote its entire energies to its duty of adequate and comprehensive service to the public. Broad, honest and courteous service at every point of contact with the public makes for contented and satisfied consumers. We all know that a sound substantial income, as the result of good service to contented patrons, is much more to be desired than income based on unnecessary consumption of energy and indifference to the real interests of our consumers.

Employees' participation and the possibility of the workers becoming part owners in our industry is now a recognized fact in the electrical business as well as in the industrial life of America. No general plan or universal scheme of participation seems possible or practical for the reason that the conditions of no two undertakings are identical. A plan which has been very effective in practice provides for the purchase by employees on small installments of capital stock or securities of the properties with which they are identified. Interest on deferred payments is generally carried by the concern at ordinary interest rates, but the employees receive dividends at a higher rate in proportion to the earnings of the properties and consequently acquire a vital interest in the success of the business. In this way thrift is combined with ownership and participation and a strong incentive is given for increased production, accompanied by saving. Enduring benefits resulting from the participation of workers in the business in which they are engaged cannot go beyond the sharing of profits or earnings. To place the management of the industries in the control of those untrained in the administration of such affairs would result in disaster, frustrating the very ends which coöperation is seeking to achieve.

The granting of pensions on retirement of the workers in old age and of disability benefits to those who have served well but may have become disqualified for service is another great feature of employees' welfare.

## SALE OF SURPLUS WAR ELECTRICAL MATERIALS

### Price-Fixing Charts to Designate Values Put Upon Surplus Materials Purchased by War Department and Not Needed in Peace

The electrical appliances and technical instruments sections of the surplus property division of the War Department are now preparing price-fixing charts designating the selling prices for all surplus electrical goods and equipment which will be sold by the Director of Sales.

These charts will be very similar to the charts prepared by the machine-tool section. The fixing of prices for all electrical goods and equipment precludes the sale of this material, except, probably, in a few instances, by sealed bids or auction.

The material to be sold in this fashion varies from motors, generators and power-plant electrical parts to small quantities of telephone, telegraph and radio instruments, wire, switchboards and laboratory instruments. While the exact quantities of the various articles are not known, owing to the delay in the receipt of inventory figures from the army camps and supply depots, it is believed that the quantities will be much smaller than had been anticipated. This will be true because of the sales already negotiated of entire plants owned by the government and a number of army camps. One of the largest items in the technical instrument section is $400,000 worth of cables.

The charts have been submitted to the American Institute of Electrical Engineers for approval.

## VAIL ELECTRICAL LIBRARY OF MASSACHUSETTS "TECH"

### Present of Executive of the American Telephone and Telegraph Company Catalogued—It Comprises About 20,000 Volumes

Additions have been made recently to the Vail Library of the Massachusetts Institute of Technology. This library was collected in England by Mr. Dering, who became very much interested in electricity and had his bookseller send him everything relating to that subject. The collection comprises about 20,000 volumes, including pamphlets and dissertations. There are books in many modern languages as well as early and rare books in Latin, some bound in vellum and others in beautiful leather bindings.

The rarities include such books as Gilbert's "'De Magnete" 1600 (first edition); Æpinus' "Tentamen Theoriæ Electricitatis et Magnetismi," 1759, and Cabeo's "Philosophis Magnetica," 1629. All subjects relating in any way to electricity are included and in nearly every case are complete to the year 1912. Nearly all of the books relate to electricity, magnetism and electrical engineering, including alternating and direct currents, railways, telephone, telegraph, wireless, etc. In addition there are books on electrochemistry, electrometallurgy, electrotherapeutics, world expositions and electrical congresses. There is also an interesting collection on the early developments in aviation.

In 1912 Theodore N. Vail, then president, now chairman of the board of the American Telephone & Telegraph Company, purchased the library and very generously gave it to the Massachusetts Institute of Technology for the electrical engineering department, first to be catalogued and then to be brought up to date. Recent books on electricity and electrical engineering are being added to make the library of the greatest possible use to the students in the institute and all others interested in the study of electricity. The original collection is now catalogued and about 1000 new boows have been added. The institute has given a large room in the main building for the Vail Library, and from thirty to forty readers may be accommodated at one time. Sixty-three periodicals are kept on file, many of which are not taken elsewhere in Boston.

The Vail Library is independent of the main institute library and is a unique collection. It is the only electrical engineers' library of its kind in New England and as far as is known is the third in the United States. Such a collection of books on electricity and electrical engineering, offering as it does a wide and interesting field for research and study, is invaluable to technology. The library is open to the public for reference and research.

The library itself is very attractive in appearance. Each book is numbered in gold with a seal ("Vail Library") stamped above the number. The front cover of each book contains the Vail Library bookplate. This bookplate was designed by Sidney L. Smith, a noted Boston engraver, and bears a fine portrait medallion of Mr. Vail. The words "Vail Library" are engraved above the portrait, and below is the inscription "'Gift of American Telephone and Telegraph Company, Massachusetts Institute of Technology, 1912."

This gift is thus not only a great asset to the institute and to its students but also to Massachusetts and its citizens. Miss Dorothy G. Bell is librarian.

## CALIFORNIA POWER SITUATION IS DISCUSSED BY A. I. E. E.

### Proposals to Interconnect Properties from Pitt River to Los Angeles on 220-Kv. Transmission Line

At the Pacific Coast convention of the A. I. E. E., held Sept. 18-20 at the Hotel Alexandria, Los Angeles, Cal., very interesting technical sessions and the delightful hospitality of the local section combined to make a successful meeting.

The major question discussed was the proposal to establish a 220-kv. transmission "busbar" to interconnect the great prospective water-power developments of California and the load centers. It is proposed to make the present 150-kv. system of the Southern California Edison Company, extending from Big Creek to Los Angeles, the southern portion of a transmission system extending to the Pitt River in the north. The discussion brought out that the plan involves no excessive advances in construction features. Questions of ownership, control and operation would require extensive study. With the completion in the near future of an interconnection of the Pacific Gas & Electric system with the San Joaquin Light & Power system in the San Joaquin Valley, actual interconnection for transfer of small amounts of power will exist from the California-Oregon line on the north to San Diego on the south. The inadequacy of the present interconnections was emphasized by several speakers.

The great advantages of a large-capacity "busbar" include its value in emergencies, making practicable the development of small isolated power sources, the benefits of diversity both in loads and in water supply, and making possible larger developments than could be handled by one company singly at a given time. The possibilities of advantage by the extension of such a system into Arizona and on the north into Oregon and Washington were suggested. Such a transmission system would be made up for the most part of lines required in any event by existing companies.

#### Railroad Electrification

The committee on railway electrification of the San Francisco Section presented a report on its organization and emphasized the challenge of the present serious situation with respect to the supply of fuel oil. F. H. Fowler of the United States Forest Service presented for the committee a paper on the water-power resources of California, showing that ample hydroelectric energy is available for prospective railway electrifications. Discussion emphasized the fact that water power can be developed, very greatly reducing the consumption of fuel oil. Other advantages of electrification were pointed out.

L. M. Klauber of the San Diego Consolidated Gas & Electric Company presented a method based on the mathematical theory of probabilities for determining most economically the number of suspension insulator units for a transmission line. In the discussion Mr. Shoemaker of the Great Western Power Company described tests made to equalize the potential gradient along a string of ten suspension units by means of metallic disks between units.

Prof. L. F. Curtis of the University of Washington presented a paper on the determination of harmonics in voltage wave forms by indicating instruments. A paper was presented by Prof. H. V. Carpenter of Washington State College on the predetermination of synchronous phase-modifier performance based upon the Perrine-Baum diagram. A very successful feature of the meeting was a series of brief papers on operating difficulties.

It was voted to hold a convention next year, arrangements being left in charge of Vice-president John B. Fiskin of Spokane, Wash., who presided over the convention.

## HIGH QUALITY OF ELECTRIC STEEL WELL ESTABLISHED

### Electric Furnace Association Issues Booklet Containing Comparative Data on Electric Steel and Other Steels

The Electric Furnace Association, which met in Chicago Sept. 22, brought together some of the foremost electric steel men of the United States and Canada. The purpose of the association is to bring out the superior quality of products made in the electric furnace. An interesting discussion of this subject occurred. The association is the outgrowth of a meeting held in New York last April which was attended by electric furnace men and at which time it was recognized that there was great need for closer coöperation between the electric furnace designer, the power engineer and those who operate electric furnaces. The association is not an offshoot of any other society and its policy will be to cooperate with all other societies and associations that are interested in electric furnaces or the products of electric furnaces.

There were about sixty present at the meeting. H. C. Weidenthal read a paper in which he pointed out the great demand for better steel in the automotive industry and indicated the increased demand for electric steel in that field. He recited the great need for greater factors of safety in the vital parts of automobiles, trucks and tractors and showed that the electric furnace would be called upon to supply steel of the proper quality.

In response to a demand for data on electric furnace products, the association has gathered together some information in regard to the high quality of electric steel and issued it in the form of a booklet. Those who attended the meeting commended this effort, and a large number of the booklets were requested. In addition to data on quality, the booklet also contains some statistics on the growth of electric steel production.

A permanent organization was effected and the following officers elected: President, Acheson Smith; vice-presidents, C. H. Booth and W. E. Moore; secretary, C. G. Schluederberg; treasurer, F. J. Ryan. The executive address of the association is Post Office box 616, Niagara Falls, N. Y.

The next meeting of the association will probably be held next spring in conjunction with some of the national technical societies, and it is probable that a symposium on the subject of power for the electric furnace will be the principal feature of the meeting. This will give an opportunity for the power engineer and the electric steel men and others operating electric furnaces to discuss thoroughly the power service problem of the electric furnace. Although the present meeting was largely devoted to electric steel, it is the intention of the association to take up the subject of non-ferrous metals and other materials made in the electric furnace.

# PRESIDENT BALLARD URGES OPTIMISTIC INDUSTRY

## Trying Problems of Reconstruction and Greater Public Interest in Utility Policies Discussed at New London

R. H. Ballard, president of the National Electric Light Association, and William C. Bliss, chairman of the Rhode Island Public Utilities Commission, counseled the members of the New England Section of the N. E. L. A. at the New London convention last week courageously to face the problems of the times, to see to it that the opportunities of the industry are seized and developed and to provide for the future on the basis of a thorough understanding by the public of the aims and conditions surrounding the utilities. President Ballard pointed out that the geographic section offers the best opportunity for closest affiliation between employers, employees and others, bringing about and keeping mutual understanding, eliminating petty jealousies and fancied injuries, and working together for the growth of service. He pointed out that the reconstruction period is in some respects more trying than war, but that the electrical industry should not be stampeded by the noise of a small minority into fits of depression. Increased production is greatly needed in order to reduce inflation and excessive unit prices.

### Work To Be Done

The development of water powers, President Ballard said, is a very important part of the solution of reconstruction problems. The national association has the advantage of a strong committee on this subject, headed by F. T. Griffeth, president of the Portland (Ore.) Railway, Light & Power Company, an expert on hydroelectric development. The partial electrification, even, of the steam railroads will mean an enormous saving in fuel and rolling stock. Service which meets the customer at every point of contact—the 100 cents on the dollar kind—which involves honesty and square dealing throughout the industry, is not too high an ideal to be realized. All are at best but servants of the public, the speaker pointed out, and regulation has put the utilities in the position of working purely for wages instead of for profits. The difficulties confronting a public utilities commission where the public is aroused on account of discourteous employees and inadequate service are so great that just findings are rendered in such cases only under extreme difficulty. "Put yourself in a commissioner's place under such conditions," said Mr. Ballard, "and think how close you may come to being mobbed if you issue a decision favoring such a company'c case even where it is justified." On the other hand, where a company and its employees are doing the best which is possible, a commission will stand for just treatment through thick and thin.

Within the industry, President Ballard said, it is desirabel that compensation shall be adequate to maintain employees and their families in reasonable comfort, including provision for old age, when earnings must be lessened. In the last hundred years productive capacity per capita has exceeded that of the 1500 years previous. A point has been reached where it requires a good deal of capital to go into business and stay there. Closing, the speaker outlined the value of employee ownership of company securities as a means of sharing the profitable advancement of the industry with the workers therein, participation being an excellent antidote against unrest and anarchistic tendencies throughout all industry. One of the California companies is working this participation plan out on a basis which comes down to the virtual addition by the company of 25 cents for every dollar the employee saves. This sharing in security return conserves loyalty and is one of the most powerful agencies against Bolshevistic ideas.

Chairman Bliss wasted no words in informing the convention that the policy of absolute frankness in dealing with commissions is a vital necessity of successful regulation and the protection of utility properties by the commission against the attacks of Bolshevistic elements. He declared that a large volume of prejudice exists to-day against utilities because the generation now attaining maturity was influenced in its youth by the disclosure of the evils of banker management, mismanagement, improper mergers and other schemes for profiting by the manipulation of utilities. He questioned the fate of public utilities during the war without the protection of the commissions. Public sentiment and the spirit of socialism grew out of the war, and the commissions have stood up and tried to do justice to the utilities.

Mr. Bliss pointed out that Germany has prohibited the manufacture of luxuries in order to produce more necessities and showed that the United States must either increase its production or reduce its inflation if the cost of living is to go down. He paid a high tribute to the work of electric utilities during the war, and in concluding urged the increase of mutual confidence between the utilities and the public as a safeguard toward future good relations and stability of business. Too often, the speaker said, the influential members of the public have little realization of the extent to which the commissions are obliged to listen to the attacks of extremists, and to arouse the great mass of well-intentioned, solid citizens to the threatened dangers confronting utilities is one of the most important things which can be done. Unless public sentiment is enlisted on the side of the upright utility, commission regulation will be swept away in a tide of socialistic endeavor to communize all quasi-public facilities.

F. R. G. Gordon, Boston, Mass., was the last speaker, his subject being the perils of socialism in relation to public utilities. For more than an hour the audience, which included many women, listened intently to the speaker's portrayal of the wastes and perils of government ownership and operation. A. B. Lisle, chairman of the public policy committee of the New England Section, presided.

**RED CROSS—**

**Monitor of Americanism**

**at Home and Abroad**

**Facing but the beginning of its task for Humanity, asks you to enlist with your local chapter as one of the Million Volunteers who will put over the great Third Roll Call November second to eleventh—Armistice Day. Mobilize Hearts, Dollars, Hands to enroll Twenty Million souls—Duty Calls YOU.**

## *Commission Rulings*

Important decisions of various state bodies involving or affecting electric light and power utilities.

**Cost of Fuel.**—Approving increased rates for the Portageville Light & Power Company, the Missouri Public Service Commission expressed the opinion that it is likely that the cost of fuel will be less in the future than in 1917 and 1918. It urges the company to make every effort to increase the demands and number of its consumers. "The consumers," it says, "should understand that increasing the number of consumers and the quantity of electricity sold will enable the company to reduce its rates." The company was not permitted to continue making a charge for meter rental as such a charge has been held to be unlawful in the state.

**Revision of Rate Schedule.**—The Pennsylvania Public Service Commission has ordered the Philadelphia Suburban Gas & Electric Company to amend its rate schedules so as to contain rules for determination of "demand" in harmony with the rest of its rates and so as to recognize variations in demand in reduced or increased minimum or demand charges. The complainant in the case was the Phoenixville Valley Forge & Stratford Electric Railway Company, and its allegation of unreasonable rates was dismissed. The commission said in part: "The complainant, through changes in operating conditions, may be successful in reducing materially not only his use of energy but also the demand upon the respondent's system, and, if so, should then be entitled to a lower minimum than the present tariffs of the respondent provide. The respondent should not only make provision in its schedules to enable its patrons to take advantage of such changes in operation, but should also place in its rate schedules a definition of how the demand is to be determined and make its determination and the charge harmonize with the minimum and the demand charges in its rate schedules covering other classes of service. In the light of the testimony offered at the hearings subsequent to its order of Oct. 23, 1917, the commission is of the opinion that the cost of the service received by the complainant is in excess of $5,000 per annum, and that the rates complained of, including the minimum requirements, are not excessive and unreasonable. The complaint will be dismissed and the respondent will be directed to make provision in its rate schedules for a definition and determination of demand that will be in harmony with the rest of its rates, and to modify its schedules in such a manner that reduced demands by the complainant can receive recognition in reduced minimum or demand charges."

**Charge for Extensions.**—The Washington Public Service Commission has given authority to the Puget Sound Traction, Light & Power Company to charge for extensions to residences not on established circuits. For setting one pole and making service extension the new minimum is $2 a month, or $3 for two poles to one customer. The customer is to pay for all construction of more than two spans. The increased service schedule is to be carried in contracts running three years.

**Amortization of Part of Purchase Price.**—The Illinois Public Utilities Commission has authorized the Central Illinois Electric Company to sell to the Argenta-Warrensburg Electric Company the distribution systems and transmission line in and connecting the villages of Argenta, Warrensburg, Forsyth and Oreana for $25,000, though it was valued at $23,500 on condition that the difference between the fair value of the property and the purchase price be amortized from income over a five-year period and no portion thereof be charged to operating expenses or capital.

## *Associations and Societies*

A complete Directory of Electrical Associations is printed in the first issue of each month.

**Electrical Men Organize in Upper Michigan Peninsula.**—All electrical contractor-dealers of Houghton County, Mich., and the Houghton County Electric Light Company have recently organized the Copper Country Association of Electrical Contractor-Dealers. H. T. Hosking of Calumet, Mich., has been elected chairman and R. A. Gordon, commercial agent of the Houghton County Electric Company, has been elected secretary and treasurer. C. McCleary of Detroit was present at the preliminary meeting and explained the advantages to be derived from affiliation with the state and national associations of electrical contractor-dealers. At the first regular meeting of the local organization, held at Calumet, Mich., Sept. 16, every member joined the state and national associations. The association intends to send a committee through the Copper Range section of the state in an effort to organize the entire upper peninsula into a large and influential section of the state association.

**St. Louis Electrical Board of Trade.**—The transformation of the St. Louis Jovian League of Electrical Interests into the St. Louis Electrical Board of Trade has been completed, and the first meeting of the new organization took the form of a banquet on the evening of Sept. 23. Members of the Association of Iron and Steel Electrical Engineers attending their thirteenth annual convention were the guests of the evening. Ike Hedges of Cupples Station officiated as toastmaster and introduced J. S. Tritle, district manager of the Westinghouse Electric & Manufacturing Company, who is the first president. Col. E. J. Spencer, who recently returned from France, is secretary-manager of the organization. H. J. Pettengill, president of the Southwestern Bell Telephone Company, outlined the aims of the St. Louis Electrical Board of Trade to the members. W. A. Layman, president of the Wagner Electric Manufacturing Company, explained the interdependence of the St. Louis electrical industry and its board of trade. The meeting was also addressed by Paul M. Lincoln, East Pittsburgh, Pa.; Col. A. T. Perkins, general manager of the United Railways Company; Prof. V. Karapetoff of Cornell University and Prof. A. C. Lanier of the University of Missouri.

**Illinois State Electric Association.**—The first annual meeting of the Illinois State Electric Association since the war will be held at Chicago on Oct. 23 and 24. The following program has been prepared: "What the Association Can Do for Its Members," by President B. J. Denman; "How to Present a Case to the Commission," by Bert H. Peck, general manager Southern Illinois Light & Power Company, with discussion led by F. A. Warfield of the Illinois Traction System, Peoria; "Selling Goods and Service," by George H. Jones, Chicago, who will speak on "Power"; Oliver R. Hogue, Chicago, "Light"; E. A. Edkins, Chicago, "Merchandise," and Harold Wright, Chicago, "Handling Customers' Contracts"; "Lighting Protection for High-Tension Lines," by Alfred Herz, Public Service Company of Northern Illinois; "Installation and Periodic Meter Tests," by L. Owen, Central Illinois Light Company, Peoria, discussion led by R. B. MacDonald, People's Power Company, Rock Island; "Outdoor High-Tension Substations," by H. W. Young, Delta-Star Electric Company, Chicago, discussion led by Harry Caldwell, Public Service Company of Northern Illinois, and John Leisenring of the Illinois Traction System, Peoria; "Extensions of Electric Service to Rural Customers," by D. E. Snyder of the Bloomington & Normal Railway & Light Company, discussion led by E. H. Negley of the Canton Gas & Electric Company; "Factory Lighting," by W. A. Durgin, Commonwealth Edison Company; "Value of Statistics in Central-Station Operation," by E. J. Fowler, Commonwealth Edison Company, with discussion by H. E. Weeks of the People's Power Company; "Development of Favorable Public Opinion Toward Public Utilities," by John F. Gilchrist, Commonwealth Edison Company. The convention will be held at the same time the Electrical Trades Exposition is on in Chicago.

# Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Regulations Reasonable.**—The New Jersey Board of Public Utility Commissioners after a hearing in a report of its inspection of the municipal electric plant at Madison ordered specific improvements. The board held that, in the absence of any proof to the contrary, rules, regulations or recommendations adopted by it will be presumed to be reasonable.

**Army Engineer Commends Louisville Company.**—The Louisville Gas & Electric Company coöperated with the government in the construction of an electric transmission line from the company power station in Louisville to Camp Knox, near Stithton, Ky. The following is from a recent letter from Major W. H. Radcliffe, constructing quartermaster: "I take this opportunity to express the appreciation of the government for the service you rendered during the past emergency. It has been a pleasure for the constructing quartermaster and his organization to work with you, and the broad, patriotic manner in which you conducted this responsibility indicates to our mind that, in spite of allegations to the contrary, there were corporations that were fundamentally as patriotic as the individual. You have indeed cause for congratulation."

**Armature Winding for Man with Defective Vision.**—August Marten served as a first-class blacksmith on board a rescue ship. Off the coast of France an explosion occurred, wrecking the ship. A hot spark lodged in Marten's left eye, causing total blindness, and affecting the right eye. The shock of the explosion impaired his hearing and generally affected his nervous system. The following eight months were spent in a hospital. According to his former employer, "he drew the highest wages ever paid a blacksmith in his mining camp." Now he could not determine welding heat or tempering colors or perform other necessary functions in that occupation. He was informed of the provisions of the rehabilitation act, and upon his arrival in Seattle he went to the federal board office. The problem resolved itself into this: An earnest, willing worker, an unusual degree of mechanical ability, handicapped with poor vision and hearing, with a keen interest in electricity. With the concurrence of the eye specialist, Marten was recommended for a course in the Seattle power plant, where he made exceptionally fine progress. Upon completion of his training he was directed to the placement department of the federal board. A position was found for him in Seattle. He writes: "I went right into high-class work with this firm and so far I have handled it well." He is winding armatures at $4 per day.

**New Tax Law in Indiana.**—The most important law affecting public utilities passed in Indiana within the last year is a tax measure under which all property is supposed to be taxed upon the same basis. Utility men believe that the theory of this law is right even though some utilities may have to pay higher taxes than formerly. The belief is that in the end it will work out advantageously since taxing authorities can scarcely put a value on property for taxation purposes without permitting the utilities to assume the same value for rate-making purposes.

**Minneapolis Company's New 33,000-Hp. Turbine Completed.**—The new 33,000-hp. steam turbine which the engineering department of H. M. Byllesby & Company has been installing in the Riverside station of the Minneapolis General Electric Company has been completed and turned over to the operating department. This generating unit brings the capacity of the Riverside station up to 70,000 hp., or more than four times as great as in 1911. The business of the company has grown so rapidly that the peak load at present often exceeds the greatest peak in the company's history, which occurred last December.

**New England Power Company Additional Securities.**—The New England Power Company, Boston, has petitioned the Massachusetts Gas and Electric Light Commission for authority to issue $950,000 par value of additional securities, divided into $600,000 first mortgage bonds and $350,000 preferred stock. The proceeds are to be used as follows: Extensions to generating stations, $380,600; new transmission lines, $1,400; extension to existing transmission lines, $201,900; new transformer and switching stations, $41,000; extensions to existing transformer and switching stations, $339,500; extensions to existing distribution lines, $2,100. The stock is to be issued at par. The board will hear the company on Oct. 8 at Boston.

**Westinghouse War Memorial Scholarships Awarded.**—The awards of the four annual war memorial scholarships of $500 each established by the Westinghouse Electric & Manufacturing Company have just been announced. These awards were made by competitive examinations, and the following men were successful: Herbert S. Pahren, order clerk, Cincinnati office, who has selected a technical engineering course at the University of Wisconsin; Arthur Marthens, cost department, East Pittsburgh, Pa., who has chosen a course in electrical engineering at the Carnegie Institute of Technology; Paul O. Langguth, draftsman, East Pittsburgh, who has selected an electrical engineering course at the University of Pittsburgh, and Andrew P. Lesniak, production department, East Pittsburgh, who has selected a course in mechanical engineering at the University of Pittsburgh. Each scholarship carries with it an annual payment of $500 for a period not to exceed four years. These scholarships have been established as a memorial to those employees of the company and its subsidiaries who entered the service of their country during the war. Four awards will be made each year, so that after three years this company will be maintaining sixteen of these scholarships.

# Recent Court Decisions

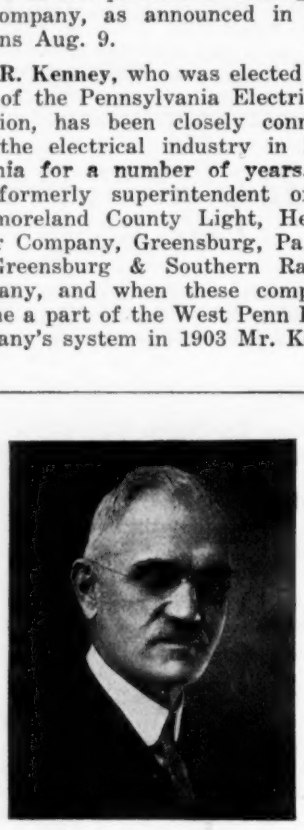
Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Picking Up Fallen Wires.**—In an action against a power company for injuries to a boy when he picked up a burned-through and fallen wire at the edge of the sidewalk, instruction that companies supplying electric energy are bound to use reasonable care in the construction and maintenance of their lines, etc., held not erroneous as abstract and misleading, the company having attached the wire to a tree with only 6 in. clearance between it and the limb. In an action against a power company for injuries to plaintiff while attempting to throw a broken wire from the edge of the sidewalk the court properly refused to instruct that plaintiff had no right to touch the wire unless it interfered with his passage along the street and that if he voluntarily touched the wire there could be no recovery, such charges limiting plaintiff as a traveler along the street to an extent not warranted (Commonwealth Public Service Company versus Lindsay, 214 S. W. 9).

**Distinction Between Utility and Business Corporation.**—A corporation which under the certificate of incorporators was to operate only on private property and manufacture electricity only for itself and tenants, though the certificate stated that the incorporators were acting under a provision of the transportation corporations law relative to electric light corporations, held not to be such a corporation, but a business corporation, in view of sections of the act declaring the purposes for which electric light corporations may be incorporated and indicating that they are always subject to the duty of service to the public. The business of a private manufacturing corporation not being "of the same general character" as that of a public service corporation, the certificate of such a corporation may not, under the stock corporation law, be amended so as to transform it into an electric light corporation (Cayuga Power Corporation versus Public Service Commission, Second District, New York, 124 N. E. 105).

E. A. **Harris** has been appointed manager of the Barre office of the Montpelier & Barre (Vt.) Light & Power Company, as successor to C. F. Millar. Mr. Harris will, in addition, assume the duties of assistant manager of the company under the direction of C. J. Cookson, who was recently appointed to the position of manager of the company, as announced in these columns Aug. 9.

**W. R. Kenney,** who was elected president of the Pennsylvania Electric Association, has been closely connected with the electrical industry in Pennsylvania for a number of years. He was formerly superintendent of the Westmoreland County Light, Heat & Power Company, Greensburg, Pa., and the Greensburg & Southern Railway Company, and when these companies became a part of the West Penn Power Company's system in 1903 Mr. Kenney



W. R. KENNEY

was retained as superintendent at Greensburg and was also given charge of the plant at Manor. In 1908 Mr. Kenney was transferred to Connellsville to become superintendent of light and power of Division A of the West Penn Power Company, which position he still holds.

**David Daly,** general manager of the Houston (Tex.) Electric Company and the Galveston-Houston Electric Railway Company, has been transferred to Keokuk, Ia., where he will serve as district manager of the Mid-West properties of Stone & Webster. He will also have charge of the Mississippi River Power Company. Mr. Daly was born in Boston, Mass., Oct. 16, 1878. After graduating from Harvard University he entered the employ of Stone & Webster in Boston where he served in various capacities. Later he was appointed local manager of the Ponce (Porto Rico) Railway & Light Company. Returning to the United States in May, 1905, he was appointed manager of the Houston (Tex.) Electric Company, succeeding H. K. Payne, and in August, 1905, was made manager of the Galveston-Houston company.

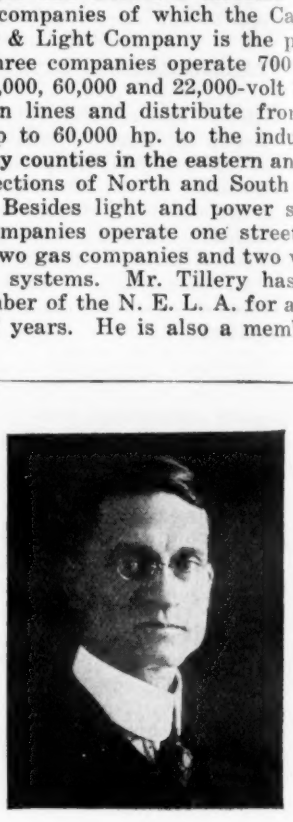
# *Men of the Industry*

Changes in Personnel and Position—
Biographical Notes

**Frederick S. Dellenbaugh,** who was a captain in the Signal Corps in overseas service during the war, has been appointed instructor in electrical engineering at the Massachusetts Institute of Technology, where he will devote his time to the teaching of dynamo design and the mechanical applications of electric power. Mr. Dellenbaugh was graduated from the electrical engineering course at Columbia University in 1910 and has been in the employ of the Crocker-Wheeler Manufacturing Company and the Westinghouse Electric & Manufacturing Company in the design and commercial engineering departments.

**R. J. McClelland,** who for a number of years has held the position of chief engineer of the Electric Bond & Share Company, has announced his resignation on Oct. 1 to organize a private business in investment securities under the name of R. J. McClelland & Company, with offices at 100 Broadway and 516 Fifth Avenue, New York. He had been a member of the engineering staff of the Electric Bond & Share Company since 1906, shortly after formation of that company. As chief engineer he has had charge of all extensions, improvements, expenditures, consultations and purchases. During late years he has taken an active interest in N. E. L. A. activities and since 1916 he has been chairman of the Technical and Hydroelectric Section.

**P. A. Tillery,** who has been elected president of the Southeastern Section of the National Electric Light Association, is vice-president and general manager of the Carolina Power & Light Company and its subsidiary companies at Raleigh, N. C. He was born in Halifax County, N. C., thirty-nine years ago and was graduated from the Virginia Military Institute at Lexington, Va., with the degree of E. E. in 1902. He then went through the apprentice course of the General Electric Company, returning to the Virginia Military Institute in 1903 as assistant professor of electrical engineering. During the following year he completed work which gave him the C. E. degree. Mr. Tillery entered the public utility field in 1904 as manager of the lighting plant at Washington, N. C. In 1909 he joined the organization of the Carolina Power & Light Company as chief engineer and has been rapidly promoted to his present position as the activities of the company have expanded. In 1911, when the Yadkin River Power Company was incorporated, he was appointed chief engineer, and in 1915 he became assistant general manager of both companies. When the Palmetto Power & Light Company was organized in 1917 his duties were extended to include the work of that company also. On Jan. 1, 1919, he was appointed vice-president and general manager and elected a director of all three companies of which the Carolina Power & Light Company is the parent. The three companies operate 700 miles of 110,000, 60,000 and 22,000-volt transmission lines and distribute from 50,000 up to 60,000 hp. to the industries in forty counties in the eastern and central sections of North and South Carolina. Besides light and power service the companies operate one street railway, two gas companies and two waterworks systems. Mr. Tillery has been a member of the N. E. L. A. for a number of years. He is also a member of



P. A. TILLERY

the Rotary Club and the local clubs of Raleigh and prominent in the social and political life of the community.

**Dr. L. H. Baekeland,** honorary professor of chemical engineering in Columbia University, has been decorated by King Albert of Belgium.

**H. H. Harding** has been appointed superintendent of the Hudson (Wis.) division of the Northern States Power Company, succeeding F. Hardwick, who was transferred to the Stillwater division.

**Herbert S. Evans,** professor of electrical engineering, University of Colorado, has been appointed dean of the College of Engineering, succeeding Prof. Milo S. Ketchum. Professor Evans was acting dean during the absence of Professor Ketchum during the past school year. He is president of the Colorado Section of the American Institute of Electrical Engineers.

## Obituary

**H. E. Marshall,** president of the Linemen Protector Company, Detroit, died recently at his summer home at Willow Beach, Canada, after a long illness.

# TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

## ELECTRICAL PRODUCTION LITTLE AFFECTED BY STRIKE

### Stocks Are Generally Sufficient for Remainder of Year—Conduit and Fittings Production Is the Hardest Hit

While it is impossible to know definitely just what the full effect of the steel strike will be in the electrical industry, it is decidedly apparent from a survey made of conditions in more than 100 of the more important electrical manufacturing plants that the electrical industry has no reason to view the present situation with any alarm. With the exception of a plant here and there, the industry is in a position to keep up current production for the remainder of the year, even if no further stock of iron and steel should be received. It is doubtful if stocks would hold out much after the first of the year. It is very unlikely, however, that the steel strike will ever reach proportions sufficient to bring about such a condition.

In the eastern part of the country apparatus manufacturers seem to be well supplied with iron and steel raw materials. One of the larger producers reports sufficient stocks of steel and iron—electrical sheets, casting iron, axle steel and sheets—to last for six to eight months.

Another large company anticipates no embarrassment for the next three or four weeks so far as steel stocks of standard shapes and sizes, including sheet steel, are concerned. The situation regarding special forgings, in the case of this company, and special shapes which are largely purchased to order, is, of course, materially affected by the strike conditions. In addition, after thirty days there is a possibility of exhaustion of stocks in certain sizes and shapes, and particularly sheet steel, which may by that time begin to affect production. Stocks of motors and transformers held at factories are low, and emphasis is being placed on keeping district warehouse stocks as high as possible.

Much interest centers in the rigid-conduit and flexible armored-conductor fields. Manufacturers have little stock of rigid pipe and fittings at the factories. Under a normal movement for this time of the year their local warehouse stocks would probably last from one to two months. Abnormal buying by jobbers and contractors to protect themselves would pull these stocks down in a short time. All the pipe mills are not shut down, so some flow of conduit can be expected from them unless they do close or other factors arise. Already some jobbers are attempting to lay in larger stocks of pipe to offset possible failing deliveries. Reports on all jobbers' stocks are not available, but several of them expect to be able to hold out under normal buying for from one to three months.

The armored-conduit producers are working up to capacity, but are behind on orders. While they may have a little tucked away for emergencies, in general they have small stocks. Jobbers, too, have short stocks of this material, and with the present heavy demand they would soon disappear. Manufacturers of the steel strip are at present responsible for keeping this commodity going and are making good deliveries. Their stocks of raw materials are sufficient to permit them to fill orders booked to Jan. 1, barring a strike or machinery breakdown in their own mills. Some armored-conductor mills which did not order strip in time are getting further behind in production.

As a whole, the apparatus manufacturers seem to be well stocked up. The rigid-conduit mills which are going are sending out some pipe, and the steel-strip mills are making as good deliveries as in the past few months, and without breakdowns or shutdowns can probably ship for the remainder of this year without replenishing new stocks.

## RUBBER-COVERED WIRE MILLS WELL BOOKED UP FOR 1919

### Heavy Ordering on Smaller Sizes Uses Up Day Capacity, Which Is Really Lowered Through Attitude of Workers

Manufacturers of rubber-covered wire have been very busy since midsummer trying to keep up to the demand for the smaller code sizes. Factories as a rule are running to their capacity and in several cases are booked up to a comfortable day capacity for the remainder of the year on Nos. 10, 12 and 14. More business can be taken on by these mills, but only under conditions of night work if 1919 shipments are necessary. Large orders are being received for the heavier sizes of this wire, but still not in quantities sufficient to surpass current capacity.

Labor conditions have here and there been responsible for poor shipments, and in some cases have caused shutdowns to the mills. Although these latter conditions have only recently been overcome, labor is still not giving full efficiency to its work. Full capacity is really appreciably below normal on account of this one feature, with no apparent relief in sight.

Prices have been holding steady on a 30-cent base, and until a further rise in labor, copper and cotton there seems no reason to expect a higher base.

## MIDDLE WEST STEEL STOCKS SUFFICIENT FOR REST OF YEAR

### Only Three Out of Seventy-five Electrical Manufacturers Will Be Hurt Seriously and Immediately by Steel Strike

Few electrical manufacturers in the Middle West will be forced to curtail operations on account of steel shortage before the first of 1920, even if the steel strike continues. Generally speaking, concerns in Chicago seem to be carrying better stocks than concerns in smaller towns, but there are notable exceptions to this rule. An inquiry among seventy-five manufacturers in the Middle West revealed only three electrical concerns that will be hurt seriously and immediately by the strike. It showed, on the other hand, that many concerns have facilities for getting along for six months if necessary.

Perhaps the most interesting thing about the inquiry was that unmistakable spirit of readiness for a fight. The feeling is that radical labor and its employers will have to come to a show-down sooner or later, and it might as well be settled now. It was this spirit which prompted many manufacturers to reply that they could get along indefinitely if it came to a point where shutting down their factories would help the steel corporation win against its strikers.

Along this line one motor manufacturer said: "We feel as though this strike, for the benefit of everyone, should only end in one way—and that is in favor of the mills. We ourselves feel that rather than have the mills give in we should prefer to close down our factory if our stock gave out, and would be willing to stay closed until the mills win the fight." Another said: "We can hold out as long as there is a strike. We believe in the open shop." Yet another declared he

would substitute more expensive metal for steel, if necessary, to help win the strike. Many expressed the wish that the steel-mill people would be able to hold out. There was only one suggestion that the situation in iron and steel might cause electrical manufacturers to raise prices.

This survey covered practically all lines of electrical manufactured products which are made of steel in the Middle West, including washing machines, other household specialties, tools, conduit and fittings, fixtures, transformers, control equipment, motors, power-plant equipment, instruments, high-tension apparatus and steel poles. The most serious difficulty will probably be experienced by the conduit and fittings people.

## NEW ENGLAND MANUFACTURERS PREPARED FOR STEEL STRIKE

### Stocks in Good Shape to Meet Protracted Tie-Up Despite Heavy Volume of Production Now Being Handled

Electrical manufacturers in New England representing diversified products and widely separated locations are in general well prepared to meet a curtailment and even a stoppage of raw steel and iron supply, should that result from the existing strike. Shipments on pre-strike orders are coming in well, and while new business is not being accepted by the steel manufacturers on a basis of guaranteed deliveries, there is no immediate ground for anxiety. If many manufacturers should not receive a pound of steel in addition to their present raw stocks until 1920, they would be able to keep up production in good volume, and some factories are so well prepared for eventualities that they could run well toward the end of the winter without exhausting their stocks of this material. By and large, supplies good for certainly from two to four months are on hand. If the strike should succeed in cutting steel production to a small percentage of normal for six weeks to two months, unquestionably considerable inconvenience would result among some manufacturers, but the probability of partial shipments, at least during the strike period, should not be overlooked. Pig iron and iron castings are plentiful and bid fair so to continue.

This is, briefly, the situation in most of the electrical factories in New England, regardless of the kind of product. There appears no immediate danger of a shortage of motors (apart from present single-phase deficiencies), of automobile starting and lighting sets, electric irons, radiators, tableware, transformers, generators, turbines, oil-switches, ranges, industrial heating devices, control apparatus or other equipment due to the early exhaustion of local raw steel and iron stocks. The volume of trade is so great in some lines that the factories cannot keep up with their orders, but shortage of raw material is not at the bottom of this.

Many factories will substitute different sizes, shapes and kinds of raw steel and iron if particular classes run short, often, it is true, at the sacrifice of metal stock through machining, but always with the idea of putting through orders regardless of temporary shrinkages in particular lines of raw material. Scrap can be melted over for pig iron, and sheets can be cut to meet local requirements inside the usual dimensions. At this writing there appears more danger of shortages due to the increasing volume of trade than to raw-material failure. Here and there steel makers are modifying their deliveries somewhat; in other cases no notification of changes has been received, and stock ordered previously is coming along well. In the schedule-material field there appears to be little present shortage of either brass or steel attributable to the strike. No one should conclude from the foregoing that the strike, if prolonged more than a month or so, would have no adverse effect upon the electrical factories of this district; but it can be said with confidence that not for a long time have New England producers of electrical equipment and supplies been better prepared than they are to-day to meet the situation and see it through to a successful finish.

## EFFECT OF MARSH PATENT ON HEATING-APPLIANCE INDUSTRY

### Résumé of the Conditions That Brought About th Present Licensing Plan and Account of the Manner in Which Prices Are Made

A comprehensive review of the Marsh patent and its effect upon the heating-appliance industry was given by W. N. Stearns, supervisor of the patent, in a paper before the recent convention of the Southeastern Section, N. E. L. A.

This patent, which was granted Feb. 6, 1906, to Albert L. Marsh and consequently has but a few years to run, covers a nickel-chromium electrical resistance element. This patent was later sold to the Hoskins Manufacturing Company of Detroit, which in the early part of 1913 brought suit for infringement against the General Electric Company. The courts decided in favor of the Hoskins company, and shortly afterward the General Electric purchased a one-third interest in the patent.

At this time the Hoskins company had also on file a suit against one of the largest central stations for damages based not only on merchandising profit but also on the sales of energy consumed by infringing devices.

In purchasing the third interest in the patent the General Electric Company insisted on the withdrawal of this suit and of any pending against other manufacturers.

The Hoskins company realized that most of the money it was to obtain as compensation for past infringement and for the future must be earned by the heating-appliance manufacturers before the owners of the patent could get it. It was therefore provided in the licenses granted to the heating device manufacturers that they might purchase this material either from the Hoskins company or from one of the other two licensed material manufacturers.

In the contract between the Hoskins company and the General Electric Company it was provided that the latter company would be relieved from payment of royalties for the future. Therefore the Hoskins company for its own protection insisted that the prices at which the various appliances are sold in the first instance by the various manufacturers to the trade be fixed.

The heating-appliance manufacturers do not meet "every so often" and agree on certain prices which are to be placed in this schedule. The schedule is fixed by the owners of the patent, but in making these prices and terms and conditions of sale the writer, representing the owners of the patent, consults freely various parties interested and obtains their advice.

The schedule is of advantage to the manufacturer in that it gives him minimum prices at which any scheduled devices can be sold to the various classes of trade. It does not prevent the manufacturer from charging higher prices, and this practice is being followed by many.

The schedule is of advantage to central stations, jobbers and dealers in that it definitely fixed the minimum prices at which they can obtain material and they know that other buyers of similar licensed material are not obtaining better prices.

No reputable manufacturer who was engaged in the manufacture of heating appliances previous to Oct. 15, 1915, which is six months after the Court of Appeals rendered its decision, was refused a license under the Marsh patent if he could prove himself financially responsible and that he was making reputable devices.

At the present time any manufacturer who applies for a license to manufacture and sell scheduled devices would not be given a license unless such manufacturer was engaged in the business previous to Oct. 15, 1915, or unless the device in question differs radically from standard devices now being manufactured and offered for sale. The reason for this is obvious. The Marsh patent was made valuable by a number of large manufacturers who had developed and exploited the heating-appliance business in years gone by. When the time came that the schedule went into effect and other manufacturers saw that the old days of cut-throat competition were over, many of

them desired to enter the business, but the owners of the patent did not feel that they were entitled to go into the business as long as there were enough reputable manufacturers engaged in the business who could supply the needs of the country.

The owners of the Marsh patent do raise prices on heating appliances, but only because of the tremendous increase that has taken place in the past few years in some manufacturers' costs.

## METAL MARKET SITUATION

### Outside Copper Market Has Further Reduced Prices to 21.50 Cents, with Some Few Buyers

An extremely dull week of trading in copper—and, in fact, all metals—has just passed, upholding the record of the previous week. There were some sales of copper made, it is true, and not merely to small consumers. It is said that two prominent consumers of the metal took advantage of a price slightly lower than that of a week previous and added several thousand tons to their stocks. This easier price of ¼ cent to ½ cent was found only in the outside market, and copper is quoted now at 21.50 cents a pound in that market; with even a tendency here and there to shade this a bit.

There is more second-hand copper of real quality in the market than producers, who are steadily holding to 23½ cents to 24 cents, ever thought. Some of this probably was bought for Japanese account several months ago, when the price was lower than at present, and is now being resold at a profit instead of finding its way to Japan. At the same time, quite a bit of copper has been shipped recently to that country.

Export shipments of copper, it is expected, will be about 15 per cent under those of August, which month was the largest this year since January. Exports during the third quarter were almost twice those of the second quarter. Recent shipments were interesting in light of the unfavorable exchange rates still existent.

Efforts of the strikers in the steel trade have shut down some of the mills, and production has been curtailed to an extent. Recent reports show a steadily increasing net resumption of furnace and mill operations and an apparent gradual braking up of the strike. The latest efforts in the attempt to close down the Bethlehem Steel Corporation mills have had little effect on the workmen. There have been some sales of steel and iron since the strike was called, but most of this was presumably to replenish abnormally low stocks.

Scrap materials have shown a steady decline since the steel strike was inaugurated. Heavy copper scrap dropped 1½ cents in the past two weeks, heavy brass dropped 1 cent and light brass ½ cent. Old scrap zinc is off ½ cent, but heavy lead has advanced about ⅛ cent.

### NEW YORK METAL MARKET PRICES

| | Sept. 15 | | | Sept. 22 | | |
|---|---|---|---|---|---|---|
| Copper: | £ | s | d | £ | s | d |
| London, standard spot | 101 | 0 | 0 | 100 | 5 | 0 |
| | Cents per Pound | | | Cents per Pound | | |
| Prime Lake | 22.62½ | | | 22.62½ | | |
| Electrolytic | 22.12½ | | | 22.12½ | | |
| Casting | 21.50 | | | 21.50 | | |
| Wire base | 26.00 | | | 26.00 | | |
| Lead, trust price | 6.25 | | | 6.25 | | |
| Antimony | 8.50 | | | 8.50 | | |
| Nickel, ingot | 41.00 | | | 41.00 | | |
| Sheet zinc, f. o. b. smelter | 10.50 | | | 10.50 | | |
| Spelter, spot | 7.55 | | | 7.37½ | | |
| Tin | 56.50 | | | 56.50 | | |
| Aluminum, 98 to 99 per cent | 32.00 to 33.00 | | | 32.00 to 33.00 | | |

# THE WEEK
## IN TRADE

AN INCREASED movement in iron and steel wiring supplies this week served as a reminder of the labor troubles in the iron and steel plants. In spite of this condition, however, there is considerable local price cutting.

Business generally in electrical supplies was excellent during the week. Protracted deliveries prevented a greater movement.

Prices are remarkably steady. An advance is refillable fuses, higher schedule material prices on the Pacific Coast and a perceptible stiffening on wiring devices in New England were the outstanding features.

After considerable discussion, New England range sales are again going ahead in spite of the new prices. Sales in the Central West, however, are down.

## NEW YORK

Already the steel strike has resulted in heavier ordering by electrical jobbers of steel and iron products. Orders on jobbers, too, have become heavier in those products. Lengthening deliveries are causing heavier ordering in many other commodities just now. With an anticipated shortening of iron and steel stocks, no evidence has been found of any price advance in rigid conduit or iron boxes and fittings. Warehouse stocks of this material and armored conductor are not large in New York, and the shutting off of the raw steel and iron needed by manufacturers of these commodities would soon exhaust the supply. Some jobbers' incoming stocks of small sizes of rubber-covered wire, rigid conduit and armored conductor were nearly booked up by the end of the week, when the supply normally would have lasted three weeks. All jobbing material is moving well.

The electrical show in New York during the past week has created much interest in household appliances, and heavy sales of socket devices of all kinds have been reported, with particular attention being paid to dishwashers, clothes-washers, mangles and vacuum cleaners.

Building conditions are showing little change. The first hundred of a thousand homes have been started in the Flatbush section of Brooklyn, according to report, and developments in Long Island have reached the building stage at Forest Hills.

**SIGNS.**—Heavy buying of electric signs has made this season stand out prominently. Flasher signs are predominating. Factories are up to capacity, and in some cases are over-ordered. Prices show no tendency to recede, and demands of labor are here and there causing them to advance. Shipments are around six weeks.

**LAMP GUARDS.**—Sales in general are good, although the shipbuilders' strikes are cutting down the movement somewhat. Stocks are good.

**MOTORS.**—Business in small motors up to 50 hp. is good enough to keep district stocks low and in some cases dead. It is the endeavor of manufacturers, however, to keep a representative stock in district warehouses, and this is cutting down stocks at the factory. Shipments are running from six to twenty-four weeks, fractionals holding the longer term.

**FLEXIBLE ARMORED CONDUCTOR.**—Movement is heavy and stocks in jobbers' hands are dropping. No. 14 twisted is generally sold by jobbers at $80, although it can be picked up at $75 per 1000 ft., and some sales have been made at as high as $85.

**RIGID CONDUIT.**—Generally $70 per 1000 ft. for ½-in. black quoted, although here and there a price of $74 is met. Sales in the smaller sizes are heavy and stocks are fair. Little of the large size is carried by jobbers. An order for 5-in. last week had to go to the factory.

**WIRE.**—Rubber-covered wire in Nos. 10, 12 and 14 sizes is moving in large volume. No. 14 is quoted by jobbers at $10.50 to $14, with an average price of $12.

**LIGHTING FIXTURES.**—The demand is heavy, and increases to labor are advancing prices on the fixture proper from 5 to 10 per cent. Manufacturers of glassware are overordered and shipments are slow, but prices seem to be rather steady.

**FUSES.**—Larger sizes are selling better and smaller sizes are selling in a good way. List prices are holding. Discounts on Economy fuses were lowered 15 per cent. on Sept. 18 to offset higher labor charges.

## BOSTON

Jobbers are doing a splendid business, the chief difficulty being shortage of fast-moving supplies. Collections hold up well, despite labor troubles. House-wiring installations are being held back by the linemen's strike. Industrial business is active and considerable new building is going forward. New England electrical manufacturers are well stocked with raw steel and iron. The sale of appliances is proceeding at record rates. Washing machines are being absorbed as fast as they can be brought in. Better feeling exists than for a long time between central stations and contractor-dealers. Boston engineers are busy on designs and construction work. Prices are erratic, tending upward in fixtures and non-metallic flexible conduit, porcelain fittings and friction tape. Motor sales are rapidly increasing.

**WASHERS.**—The demand continues at an extraordinary volume. One dealer at the Eastern States Exposition in Springfield sold in one week twelve washers at $150 each and three mangles at $153 each.

**RANGES.**—Distributers report that ranges are now moving well at the new prices.

**INDUSTRIAL ELECTRIC TRUCKS.**—Twenty trucks were recently sold to the American Agricultural Chemical Company, various makers securing the split order. Inquiries are holding up well.

**WIRE.**—Prices are steady, with bare at 27.5 cents base, weatherproof at 29.5 cents and rubber-covered at 30 cents. Some stocks of No. 14 wire are improving.

**FUSES.**—"Economy" fuses in standard packages have increased to 35 cents from 30 cents, 3-amp. to 30-amp. rating, in standard package lots. In general, fuses are in good supply.

**FRICTION TAPE.**—Tape has risen from 42 cents to a present price of 50 cents a pound, ¾-in. black, despite easier cotton prices.

**RIGID CONDUIT.**—Prices are fluctuating, with quotations ranging from 16.4 cents per foot net to 15.8 cents in the 1-in. size, black. One jobber offered 10,000-ft. lots in this size at 13.34 cents per foot net. Deliveries are none too good and stocks are spotty.

**KNOBS, TUBES AND CLEATS.**—The demand is heavy, with shrinking stocks. Nail-it knobs are stiffer, at $16.95 per 1000, net. The 3-in. by ⅞-in. size of tubes is quoted around $5.45 per 1000, in barrel lots.

**METALLIC FLEXIBLE CONDUCTOR.**—Few jobbers have much of this material in hand and prices of $85 to $90 per 1000 ft. are given for No. 14 single-strip.

**OIL CIRCUIT BREAKERS.**—Industrial demand is reported excellent. Central station business is quiet. Factory stocks are good and prices steady. Labor is plentiful, such as it is, and materials are readily secured.

**LAMP CORD.**—Prices are stiff, with a great scarcity in silk cord. No. 18 twisted cord quotes at $20 and reinforced cord for $29.10 per 1000 ft.

**NON-METALLIC FLEXIBLE CONDUIT.**—Prices are stiffening, with good demand. Quotations around $26.50 per 1000 ft. for ⅜-in. diameter are current.

**STARTING AND LIGHTING SETS.**—One factory is running twenty-four hours a day to meet the demand. Raw material is in excellent stock. Factory stocks are almost exhausted.

**SOCKETS.**—Prices are steady, with keyless at 30 cents, pulls at 60 cents, and key sockets at 33 cents. A large Connecticut manufacturer reports brass in good supply. Deliveries are hard to make, however, in view of the demand.

**FIXTURES.**—Trade is brisk, with low stocks, long deliveries and upward tendencies in prices. Rumors of an advance of 20 per cent around Oct. 1 are current at this writing.

**ELECTRIC TRUCKS.**—Sales exceed delivery capabilities. New garaging facilities are being prepared at Boston, and manufacturing facilities in the East are being strengthened.

**TRANSFORMERS.**—Business is very good. Factory shipments are prompt, without much price movement.

**ELECTRIC RADIATORS.**—Trade is picking up with cooler weather. Recent price advances appear no deterrent to buying.

## CHICAGO

A steady business of good volume is being handled by the electrical jobbers and dealers in Chicago. Stocks in certain lines are being built up with the expectation of a large Christmas trade. Work on over $100,000,000 of construction was resumed on Sept. 22, when the carpenters went back to work after a six weeks' trade lockout. Jobbers expect an increase in trade, but a shortage at the present time in the supply of carpenters and the nearness of the winter season may prevent the volume of business from being phenomenal. Building permits in Chicago for the week ended Sept. 20 amounted to more than $4,000,000, most of these being for residences and small apartments. Construction in neighboring cities, notably Detroit, is at the highest point of its history. In St. Louis the Scullin Steel Company has signed a power contract with the Union company for about 3500-kw. demand. The Army Signal Corps is offering for sale in Chicago at current market prices about 22 tons of brass sheets, 18 tons of brass rods and some brass tubing, these all being of assorted sizes and dimensions.

**WIRE.**—The scarcity of the smaller sizes of copper wire is noticeable in the stocks of practically all jobbers. Under a good demand, prices have remained steady, with a base of 30 cents for rubber-covered, an average base of 30 cents for watherproof and a base of 28 cents for bare wire.

**SCHEDULE MATERIALS.**—All jobbers report a good steady volume of business in this material and still complain of delayed deliveries from the factories.

**OUTLET PLUGS.**—The demand for appliance outlet plugs is good on account of the large volume of house wiring which has been done lately.

**RANGES.**—A falling off in sales is noticeable.

**TAILORS' IRONS.**—Many new shops have opened and thus created a comparatively heavy demand for the tailor's goose. An average price for this appliance is about $20.

**PERCOLATORS.**—Jobbers are ordering for the expected large fall trade. A leading line quotes a price of $12.75 on a plain six-cup size in nickel.

**BELL-RINGING TRANSFORMERS.**—A steady, constant demand exists.

**SMALL MOTORS.**—A good demand exists for small motors of all sizes, but factory deliveries are very slow. One factory in this section is taking four weeks to fill orders. The largest part of the small-motor orders is for washing machines.

**POLES.**—Business conditions are very good. One large house has had about the best business in its history during the last three months. The price quoted on a 7-in., 30-ft. red cedar pole is $9.25.

**CONDUIT AND FITTINGS.**—With the steel strike already called, the situation is quite serious, because stocks in Chicago are reported to be small.

**CHRISTMAS-TREE LIGHTS.**—Stocks are being laid in by jobbers. It is thought that more jobbers will handle this line of equipment this year on account of the different

policies of the manufacturers, some of whom in the past shipped orders directly to the dealers. List price is $4 for a set of eight lamps.

## ATLANTA

So far the steel strike has been little felt in this section. All plants in the Birmingham and Atlanta districts are running on normal capacity, and all allied metal industries appear to be well stocked. Transactions in the electrical field show increases in a few items and a perceptible decrease in others; but, on the whole, the volume of business is holding up well and maintaining the averages of the last few weeks. Electrical contractors continue busy and the labor situation is quiet. Manufacturers quote collections as being very good, with a slight increase in the extension of paper to jobbers in isolated instances. A feature of interest is the recent decision of the Georgia Railroad Commission ruling that all central stations shall eliminate as soon as possible all so-called high-tension metering. In the future, all metering shall be done on the secondary side of the transformer. This action on the part of the commission has stimulated buying by central stations of new metering outfits.

**TURBINES.**—A brisk business is being had with industrials and central stations shipments are reasonable.

**PANELBOARDS.**—The very excellent demand during the past few weeks shows a slight decrease this week. Shipments, on the whole, are very good, standard cabinets being promised for one week and panels two weeks.

**STEEL BOXES.**—These are moving very well. Prices are steady and local stocks are normal.

**PRINTING-PRESS MOTORS.**—An active business is noted this week, and Southern stocks have been drawn on to complete Eastern orders where stocks are temporarily low. Promises from factory shipments are getting longer.

**CONDUIT FITTINGS.**—Jobbers report a steady movement, with local stocks in good condition.

**INCLOSED SAFETY SWITCHES.**—The market is extending rapidly. Local stocks are well filled and are kept replenished by frequent incoming factory shipments.

**CONDUITS.**—The demand for black and white rigid continues strong in the face of longer factory shipments and indefinite deliveries. The New Orleans district is absorbing large quantities of ½-in. conduit. Prices are inactive.

**METERS.**—The call from central stations is comparatively steady, while prices remain firm. Distributers have managed to improve their stocks, while factory shipments are very poor. Shipments in polyphase types are especially bad.

**ARMORED CONDUCTOR.**—Big shipments are slowing up and the increasing demand is being handled so far by driblet shipments from local stocks. Factory promises are very indefinite.

**TRANSFORMERS.**—An excellent demand exists for the 2200-volt distributing type, and Southeastern stocks have shown some improvement due to better factory shipments and also to the fact that incoming orders are not so urgent. The call for the power type is holding up well.

**FLEXIBLE-STEEL CONDUIT.**—Prices are steady. Factory shipments have been very good, and local stocks at this time are ample to take care of current needs, combined with the fact that large orders are being shipped direct to large users.

**HOISTS.**—Business is picking up, and an improvement in deliveries is noted. Inquiries are increasing daily and substantial business is being done with ice plants and shipyards.

**SMALL ISOLATED SWITCHBOARDS.**—These are moving in good shape with a tendency of slowing up in deliveries due to lack of raw material at the factories. Standing boards are promised from two to three weeks.

**STREET-LIGHTING EQUIPMENT.**—More activity is noted in this line, manufacturers reporting substantial orders in Florida this week. Lamps of 600 cp. seem to be popular. Deliveries are promised six weeks.

## SEATTLE—PORTLAND

The jobbing market presents nothing of particular interest this week beyond maintenance of a good buying movement in domestic appliances. Several jobbing houses report a slight movement in heaters and a better movement of house-wiring devices, the sale of which had dropped to a minimum since Sept 2, owing to the building strike. Buying is not expected to gain to any extent until the strike is over. Sales of motors, conduit, lamps, etc., to shipyards are at a minimum, and orders are placed only as needed. Small motors for fruit canneries, garages and shingle mills are showing increasing sales. Collections are in good shape. Deliveries from the east are getting longer, and with the immediate harvest demands at hand no betterment of the situation can be expected for some time. Unstable labor conditions are hampering business and harassing capital, and apparently conditions are growing worse. Many of the larger building projects which were tied up by the strike are now proceeding with small open-shop crews. Up to date no steel-manufacturing plant in the Northwest is affected by the strike of steel workers in Eastern steel centers. There is enough steel on hand to complete all prsnt contracts in the steel shipbuilding industry in the Northwest.

Portland district reports that business in most lines of small equipment and supplies continues about the same as reported for past month. Deliveries from the east on all kinds of electrical material are months behind at the present time, and in many respects conditions are worse than they were during war time.

The spruce production division has been receiving considerable consignments of electrical machinery and equipment, orders for which were placed prior to the armistice. This equipment is being distributed throughout this district. Northwest lumbermen say there has been a slight improvement in the car situation for the movement of their product to market and that mills of western Oregon and Washington are moving within 7 per cent of their normal output.

## SAN FRANCISCO

The electrical contracting business is very brisk, and dealers are very busy also. Local fruits, including wine grapes, have sold for the highest prices on record.

Collections have temporarily slowed up, probably owing to the overlapping of longer-term allowances on big motor-driven devices with the shorter-term wiring staples. Credits remain about the same. So far comparatively few dealers have taken advantage of the new time-payment schemes for caring for the collections from their customers.

**SCHEDULE MATERIAL.**—An advance in all standard sockets, switches, plug cut-outs and the like has just occurred, with the result that sockets and switches sell in standard packages for approximately list less 10 per cent. An advance was anticipated and many dealers laid in good assortments, many back orders are on the jobbers' files. Plug cut-outs are now selling for approximately 25 to 27 cents each in standard packages, and double-pole entrance switches about 72 cents each.

**INSULATING MATERIAL.**—Prices are decreasing, "Linotape" oilcloth having dropped about 10 per cent. Insulating varnish has increased and now sells in barrel lots for $2.25 per gallon for the clear-air drying style and $2.25 per gallon for the quick-baking style.

**WATER HEATERS.**—Prices have advanced 25 per cent plus an additional advance of 10 per cent, and demand has dropped to a mere fraction.

**GLASS INSULATORS.**—Glass insulators are slow with fair stocks on the Coast and poor demand. A 10 per cent price advance has brought the price of standard pony insulators in barrel lots to $50 per 1000, and the deep-grooved double-petticoat style to $90 per 1000.

**FLEXIBLE CONDUIT.**—Non-metallic flexible has decreased and is now selling in crate lots at $26 per 1000 for in. The demand is very brisk, with poor stocks on hand.

# NEW APPARATUS & APPLIANCES

## A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

### Gyratory Foundry Riddles

A new line of portable gyratory foundry riddles, electrically driven, are being marketed by the Great Western Man-

MOTOR DIRECTLY CONNECTED TO SHAFT

ufacturing Company, Leavenworth, Kan. These riddles are of three types. The type V, which has a 20-in. (50-cm.) sieve and weighs about 100 lb. (45 kg.), is driven by a direct-connected ¼-hp. motor. The type C-R riddle has a 24-in. (6-cm.) sieve, weighs about 200 lb. (90 kg.) and is driven by a ½-hp. totally inclosed motor. The type C-S, with a 24-in. (6-cm.) square sieve and a weight of 230 lb. (104 kg.), is designed for automatic tailing off of refuse, and therefore, unlike the other two, permits of continuous shoveling. In the types C-R and C-S the motor is geared to the shaft. The manufacturers emphasize the portability of these types and the fact that energy can be obtained from any convenient lamp socket.

### Steel-Clad Distribution-Type Transformers

A reduction in weight of more than one-third is said to be effected in the improved type S steel-clad distribution transformers made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., through the substitution of welded sheet-steel cases for those of cast iron.

No change has been made in the coil construction and insulation of these transformers, which have been on the market for many years, but an improvement has been effected in the tank construction by which, it is claimed, the light weight desired is combined with the requisite degree of strength and rigidity. The new features of the transformers include a treatment and finish of the tank surface which render it weatherproof.

The reduction in weight effected in the steel-clad transformers permits of mounting larger transformers directly on poles without building a platform. The new 10, 15 and 50-kva. transformers have about the same weight as the the old 5, 7½ and 25-kva. transformers respectively.

The material used in the manufacture of the tanks, covers and end

WEIGHT ONE-THIRD LESS THAN CAST-IRON-TYPE TRANSFORMERS

frames of the improved transformers is a specal grade of sheet steel having inherent rust-resisting qualities.

### Portable Single-Pivot Direct-Current Meters

A high degree of sensitivity is claimed by the Rawson Electrical Instrument Company of Cambridge, Mass., for its recently developed type No. 501 portable single-pivot direct-current meters, their chief characteristics being extremely high resistance as millivoltmeters and low resistance as microammeters. A clamping device permits rough handling of the meter without danger of injury to the movement.

The new meters are designed to be accurate to one-half of 1 per cent. The action is dead-beat; the moving coil vibrates freely; no temperature corrections are required, and the instruments can be corrected for zero.

These meters are supplied in full scale ranges from 18 microamp. to 1 amp. and from 1½ millivolts to 500 volts. They may be had with one, two, three and four ranges, as milliammeters

COMBINES HIGH SENSITIVITY AND PORTABILITY

or millivoltmeters, and up to twelve ranges for millivolt-milliammeters.

The Circassian walnut cases of the instruments are dust-tight and provided with slip-hinge covers and carrying straps.

Because of the unusually high resistances obtainable with the millivoltmeters, it is said that they are particularly well adapted for use in pyrometry.

### Safety Starting Switch for Small Motors

Safety for the operator, safety for the motor and equipment and safety for itself are three features embodied in a new type of starting switch for small induction motors that is being put on the market by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

The action is automatic and consists of strong springs attached to the contact parts and controlled by a trigger which is released by overload, failure of power or by hand. When the switch passes the neutral point the spring snaps it the rest of the way. Safety to the operator is assured by the live parts being entirely inclosed in a case proof against dust and dirt. Upon the return of power the handle must first be moved to the reset posi-

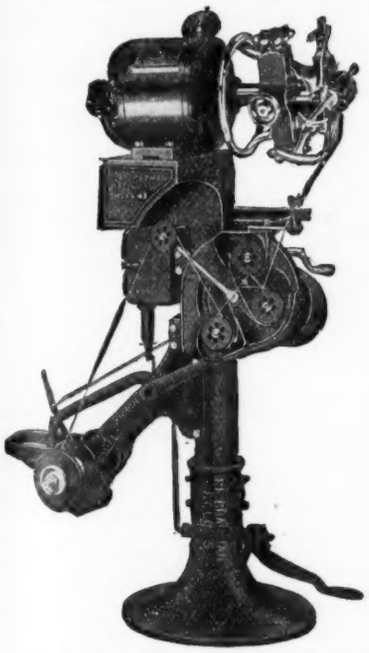
tion and then to the running position, in order to start the motor.

The overload relay may be set to open the switch at any desired point. It is provided with oil dash pots so that small peak loads and the starting current can be carried without interruption of service. The new switch uses no fuses and has an automatic reset. The contacts have been designed to open and close rapidly in order to eliminate as far as possible the injurious effects of arcing and preserve the life of the switch.

Asbestos barriers between the sets of adjacent contacts permit the omission of switch oil. Emergency-stop push-buttons may be connected in the low-voltage relay circuit and placed at any convenient point near the machine. This switch has been approved by the National Board of Fire Underwriters and is made in two sizes each for use on two-phase and three-phase motors of 10 hp. or less, while type No. 816 starts motors up to and including 25 hp.

## Machine for Winding Bipolar Drum Armatures

A more complete model of its adjustable machine for winding bipolar drum armatures is announced by the P. E. Chapman Electrical Works of St. Louis, Mo., in their style No. 3. This model, in addition to being adjustable in a few minutes for any style and size of random-wound bipolar drum



MOTOR, CONTROLLER AND TURN COUNTER INTEGRAL PARTS OF MACHINE

armatures and any size of wire from No. 20 to 36, is able, it is claimed, to wind a large amount of wire into armature slots without pounding it and also has lead forming and handling features which are said to reduce labor materially. Another feature of the new winder is that the driving motor, controller, turn counter and other necessary parts are all incorporated in the machine.

A new automatic dynamometer-controlled reel holder and tension device has been perfected, which it is claimed ends all spool troubles and enables quick starting, high speed, great tension and quick stops, so that only about five seconds is required to wind in a coil. The reel holder and the tension device are simultaneously adjusted for any size of wire. It is claimed that the output of the machine runs into hundreds of armatures per day on many sizes and kinds of armatures. The machine is designed to be easily operated; it is strongly built, and is useful both in the job shop and in the factory. It can also be utilized for winding field coils, smaller armature coils, etc.

## Iron Conduit Caplets

To separate and insulate the wires leaving the ends of exposed iron conduit "J. C. P." caplets, type AB, are

CAPLET SHOWN SEPARATED

now being manufactured by James C. Phelps of Springfield, Mass., and distributed by the Arco Electric Company, 114 West Forty-second Street, New York City.

The ½, ¾ and 1 in. (1.2, 1.9 and 2.5-cm.) sizes of these fittings are fastened to the conduit with a lock-nut, which is inclosed in a threaded ferrule. This ferrule screws on over the porcelain and holds it on the conduit; it is made of brass and protects the porcelain from breakage. The lock-nuts cannot drop out and no special style of nut is required.

When the ferrule is unscrewed the porcelain is free from the metal parts, making it easy to thread the wire through the porcelain. In sizes from 1¼ to 2½ in. (3 cm. to 6 cm.) the caplets are made with a bushing that screws on the end of the conduit. A metal yoke sits over the bushing and clamps the porcelain insulator to the bushing with two screws, drawing the two parts firmly together so that they are perfectly rigid. When the screws are loosened the bushing will swivel in the yoke and can be screwed to the conduit without turning either the porcelain or the yoke. This makes it very easy to install in close places where an oblong fitting cannot be turned. By backing the screws out further the porcelain can be removed from the rest of the fitting, making it easy to pass large size wires through it.

## Reel Equipped Extension Lamps

Two styles of its "Reelites" are announced by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago. One is a drop-cord fix-

MADE IN DROP-CORD AND PORTABLE TYPE

ture type with 12 ft. (3.6 m.) of cord and socket, for use in machine shops, providing flexibility of lighting. The other is a portable-lamp type with 25 ft. (7.6-m.) of cord, being suitable for use in garages, machine shops, etc.

The base of these lamps can be attached to a 4-in. (10-cm.) outlet box or directly to the ceiling. The cord winder is a four-spring type designed to stand severe use. Approved reinforced cord is used in the reel, which operates like a window-shade roller.

## NOTES ON RECENT APPLIANCES

### Plural Socket Plugs

The Ajax Electric Specialty Company of St. Louis, Mo., has recently improved its plural socket plug.

### Adjustable Fan Hanger Outlet

The Frank Adam Electric Company of St. Louis, Mo., is marketing its "FA" adjustable electric fan hanger outlet.

### Domestic Electric Flatiron

The Dover Manufacturing Company of Dover, Ohio, is now making an electric flatiron for domestic use, known as No. 675.

### Electric Toaster Stove

A nickel-plated, cold-rolled steel electric toaster stove rated at 500 watts is being made by the Equator Manufacturing Company of Hamilton, Ontario, Canada.

### Renewable Fuses

The D. & W. Fuse Company of Providence, R. I., has made an improvement in its renewable fuses whereby positive contact is obtained on the end of the fusible element by a threaded plug which is inserted in the cap.

## Manufacturers' Activities

PASS & SEYMOUR, INC., have opened a branch in San Francisco under the management of the George Gray Company.

THE ENGINEERING SERVICE COMPANY has moved from 5251 Cullom Avenue to 4736 Irving Park Boulevard, Chicago.

G. F. WAKEMAN, formerly assistant to the Pacific Coast manager of the Edison Storage Battery Company, has been promoted to be manager.

PAUL SUTCLIFFE, advertising manager of the Edison Storage Battery Company, Orange, N. J., has been appointed manager of the industrial truck and tractor department of the same company. Mr. Sutcliffe has been connected with the Edison Storage Battery Company for more than five years.

FRANKLIN W. GILMAN, combustion engineer with the Sanford Riley Stoker Company of Worcester, Mass., and the Murphy Iron Works of Detroit, Mich., sailed from Vancouver on Oct. 2 for Japan. He will remain in that country for about a year in connection with the installation and operation of stokers manufactured by the two companies.

THE HURLEY MACHINE COMPANY of Chicago purposes to increase its common capital stock from the present 15,000 shares of $100 par value to 200,000 shares of no par value, the new capital thus derived to be used in enlarging its plant at West Twenty-second street and South Fifty-fourth Avenue. It is also proposed to increase the number of directors from five to nine. Notice of the plan was given Sept. 17 in a call for a special meeting of stockholders on Oct. 2.

NEW HANDBOOK ON EXPORT TRADE METHODS.—The superintendent of documents, Government Printing Office, Washington, D. C., is distributing through the Bureau of Commerce a handbook entitled "Selling in Foreign Markets." The book contains over 600 pages and is prepared in conjunction with the Federal Board of Vocational Education. It consists mainly of reports and articles by experts of wide experience, either in large private business or in commercial investigations for the government.

THE CARBON IMPORTS COMPANY, INC., 110 West Forty-second Street, New York City, has an exclusive arrangement with the General Electric Company, Ltd., of London, England, for the distribution of "Kinarko" carbons, used principally by motion-picture theaters, in the United States, Canada and Mexico. Robert W. Kiewert is president and general manager of the company and has had an experience covering over fourteen years in the carbon line. At one time he was head of the Kiewert Company of Milwaukee, New York and San Francisco, importers of Siemens carbons and flaming-arc lamps. Herbert Schiff is secretary and treasurer.

THE LANE MANUFACTURING COMPANY, Montpelier, Vt., established for seventy years, until this year has confined its efforts principally to the stone-working field. About 1898, with the increased development of electric power, the Lane crane was adapted to electric drive, and during the past twenty years a large number of these electrically driven cranes have been installed, largely in the stone-working field throughout the country. Although most of the installations have been in the New England States, some of these cranes are now in service in other states from the Atlantic to the Pacific. In order to give the company's product a broader distribution it has now appointed as its sole crane agents N. B. Payne & Company, 25 Church Street, New York.

THE NEW DEPARTURE MANUFACTURING COMPANY, Bristol, Conn., has secured the old woolen mill factory in Meriden for use as an auxiliary factory which shall be directed from the Bristol offices. The investment in Meriden represents approximately $2,500,000 and includes 8 acres of railroad property. Old buildings now in the rear of the main large factory will be razed and two new brick structures erected. The manufactory will be entirely renovated and prepared for the large amount of new machinery which will be installed. Buildings now being completed at the main plant in Bristol represent an investment of $1,500,000, and the company has plans perfected for the erection of two big buildings, to permit doubling the ball-bearing plant.

## Supply Jobbers' Notes

H. J. GORKE, INC., Syracuse, N. Y., has put on an extra salesman this fall, with a view of covering the territory more closely rather than increasing in territory. This company has also taken on a new line of Sangamo meters.

E. H. WADDINGTON has recently been made Western district manager of the line-material department of the Western Electric Company. He is president of the St. Louis Electrical Board of Trade and joined the company in 1910.

THE F. D. LAWRENCE ELECTRIC COMPANY, Cincinnati, Ohio, which celebrated its fifteenth anniversary on July 24, has now the following officers: F. D. Lawrence, president; F. W. Kleine, vice-president; W. P. Sayers, secretary; H. S. Kain, assistant secretary, and A. S. Riechman, treasurer. The company has recently taken on the sale for the southern half of Ohio and the entire state of Kentucky of the Blue Bird electric clothes washer. The company reports that the machine is going very fast and that it expects to dispose of from 8000 to 10,000 by Aug. 1, 1920.

THE NORTHERN ELECTRIC COMPANY of Duluth, Minn., has made arrangements with the National Metal Molding Company, the Johns-Manville Company and the Trumbull Company to act as their distributers for various lines in the Northwest territory. The company, has recently moved into larger offices and warehouses. Its fixture manufacturing plant has been improved and new and up-to-date machinery has been added so that it may turn out a larger volume of first-class fixtures. W. M. Hogan, who was for a number of years with the Northwestern Electric Equipment Company of St. Paul and later was with the J. B. Terry Company of Cedar Rapids and the Marshall-Wells Hardware Company of Duluth, is now sales manager of the Northern Electric Company. Earle Raymond has been added to the sales force to handle the fixture line in the Northwest.

## Foreign Trade Notes

CHINESE MANUFACTURE OF INCANDESCENT LAMPS AT SHANGHAI.—The China General Edison Company, Inc., Shanghai, China, according to a report of Consul General Thomas Sammons, is now blowing approximately 150,000 glass bulbs per month. About 300 Chinese men and women are employed and are giving entire satisfaction. The Chinese employees are under foreign supervision, the average wage being about $15 Mexican per month (approximately $13.50 gold at the prevailing exchange rates, although at normal exchange rates the gold equivalent would be less than $7.50). The Chinese helpers have quickly learned sufficient English to enable them to label the various processes involved, also to keep a record of their own production. The adaptability of the Chinese to work of this kind will enable the company to extend its operations in the manufacture of electrical devices, with the ultimate result, no doubt, of considerable export business. As heretofore reported, all the materials used in the production of electric lamps come from China with the exception of metal filaments, fine glass bars and tubing.

### Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent from Chile (No. 30,614) is in the United States and desires to secure agencies for the sale of wireless-telegraphy outfits and supplies.

An agency is desired by a man in Italy (No. 30,567) for the sale of electric articles and accessories. Correspondence should be in Italian or French.

A merchant firm in Italy (No. 30,596) desires to purchase toy electric railways. Quotations should be given c.i.f. Italian port. Terms cash. Correspondence should be in Italian or French.

## Trade Publications

CRUSHING ROLLS.—The Allis-Chalmers Manufacturing Company of Milwaukee, Wis., has issued bulletin 1816 to show and describe various types of its crushing rolls.

ELECTRIC ARC WELDERS.—A number of different electric arc welders are covered in bulletin No. 700 issued by the United States Light & Heat Corporation of Niagara Falls, N. Y.

LAMP POLES AND LIGHTING BRACKETS.—Illustrated catalog No. 40 has been issued by Elmer P. Morris of New York City and covers ornamental lighting posts and lighting brackets.

LIGHTING UNIT.—The Duplex Lighting Works of the General Electric Company, 6 West Forty-eighth Street, New York City, have issued a folder covering its "Duplexalite" lighting unit.

PORTABLE ELECTRIC LAMP.—The Wizard Electric Lamp Company of San Francisco, Cal., has issued illustrated colored folders in both English and Spanish covering its electric portable lamps.

THERMOMETERS.—The Foxboro Company of Foxboro, Mass., has issued bulletin No. 104-1, superseding bulletin No. 104 and describing in its eight pages Foxboro indicating and recording thermometers.

RESIDENCE VENTILATION.—A folder has been issued by the Ilg Electric Ventilating Company, Whiting and Wells Streets, Chicago, covering residence ventilation by means of Ilg motor propeller fans.

AIR CIRCUIT BREAKERS.—Type K-2 air circuit breakers manufactured by the Condit Electrical Manufacturing Company of South Boston, Mass., are described in bulletin No. 422, which this company is circulating.

DUPLEX RECEPTACLE.—A leaflet being circulated by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., illustrates its No. 7720 duplex receptacle, which provides two outlets in the space required for one. A blueprint accompanying this leaflet indicates the location of a number of duplex receptacles in the floor plan of a typical modern home.

## New Incorporations

THE AMERICAN CONSOLIDATED ELECTRIC COMPANY of Newark, N. J., has been incorporated by Frederick Schiller, John H. McCaulley and David Lesnik. The company is capitalized at $100,000 and proposes to manufacture incandescent lamps and electrical products.

THE COOPER STORAGE BATTERY COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of $250,000 by I. J. Cooper, Eighth and Main Streets, and others. The company proposes to establish a plant in Madisonville for the manufacture of storage batteries.

THE RANDALL X-RAY COMPANY of Washington, D. C., has been incorporated under the laws of the State of Delaware with a capital stock of $100,000 to manufacture X-ray machines. The incorporators are William T. Randall, George T. and Willis W. Parker of Washington.

THE EUREKA LIGHTING SUPPLY COMPANY of New York, N. Y., has been incorporated by S. Geller, I. J. Shirmel and H. M. Fuerstein, 11 Graham Avenue, Brooklyn, N. Y. The company is capitalized at $8,000 and proposes to manufacture electric and gas fixtures and metal lighting specialties.

THE ATWATER KENT MANUFACTURING COMPANY of Philadelphia, Pa., has been incorporated by A. Atwater Kent of Ardmore, Pa.; W. J. Little of Philadelphia, and Paxson Deiter of Bryn Mawr. The company is capitalized at $5,000 and proposes to manufacture electrical and other equipment.

THE ATLAS ELECTRIC COMPANY of Pittsburgh, Pa., has been incorporated by Elmer E. Mosberger, 6222 Broad Street, P. S. Walsh, 6212 Penn Avenue, and Edward T. Mills, 6222 Broad Street, all of Pittsburgh. The company is capitalized at $10,000 and proposes to manufacture locks, keys, electrical machinery, etc.

## New England States

WEST RUTLAND, VT.—The Clarendon Marble Company is contemplating large extensions to its mill and quarry, including the opening of another quarry and additions to the marble-finishing department, which will probably require several hundred horsepower for operation of its works. The Rutland Railway, Light & Power Company furnishes electrical service to the company.

PROVIDENCE, R. I.—The Ideal Concrete Products Company, it is reported, contemplates the erection of a factory building on Hartford Avenue, corner of Dixwell Street. The project includes a power plant for operating the large mixing machines and other apparatus for the manufacture of concrete blocks.

ANSONIA, CONN.—Bids will be received by the Village Council until Oct. 14 for construction of a municipal electric light plant and waterworks system. The cost of the work is estimated at about $45,000 and will consist of the installation of two pumps, one oil engine, a 60-kw. alternator, pole line, pipe line, etc. Specifications may be seen at the office of Frank Stentzel, village clerk, Ansonia, and at the office of G. L. McKibben, consulting engineer, Van Wert.

HARTFORD, CONN.—The directors of the Hartford Electric Light Company have voted to increase the capital stock of the company from $6,000,000 to $7,500,000.

## Middle Atlantic States

CANANDAIGUA, N. Y.—Plans are under consideration by the city officials for the installation of a new street-lighting system in the business section. The Business Men's Association is interested.

CUBA, N. Y.—The Cuba Electric Light Company has petitioned the Public Service Commission for permission to make extensions to its system, including the erection of a power plant in Cuba.

NEW YORK, N. Y.—Plans have been filed by the New York Central Railroad Company for extensions and improvements to its power plant on 149th Street.

ROCHESTER, N. Y.—Ground has been broken for the proposed new plant of Bastian Brothers Company, 69 Mount Hope Avenue, to be erected on Clinton Avenue North, to cost with equipment about $300,000. T. E. Bastian is president.

HARRISON, N. J.—Plans have been prepared by the Driver-Harris Company, Middlesex Street, for the construction of a new building, to cost about $50,000. The company manufactures electric wires, cables, etc. Lockwood, Greene & Company, 103 Park Avenue, New York, N. Y., are engineers.

MAYS LANDING, N. J.—The Board of Public Utility Commissioners has granted the Atlantic County Electric Company permission to issue $35,000 in bonds, the proceeds to be used for extensions and improvements.

NEWARK, N. J.—The New Toy Company, 200 Fifth Avenue, New York, N. Y., has acquired a site at Central Avenue and Lock Street, Newark, for the erection of a new plant, consisting of a main factory and three adjoining buildings, to cost about $200,000.

NEWARK, N. J.—Plans have been prepared by William E. Quimby, Inc., 209 Parkhurst Avenue, for the erection of an addition, 48 ft. by 92 ft., to his plant at Parkhurst Avenue, corner of Avenue C, to cost about $20,000. The company manufactures electrically operated pumps and kindred specialties.

WANAQUE, N. J.—The Borough Council has granted the Tri-County Electric Company of Pompton Lakes a franchise to furnish electricity in Wanaque. Energy will be secured from the municipal electric plant at Pompton Lakes.

ALLENTOWN, PA.—Considerable new electrical and mechanical equipment will be required by the city in connection with the proposed new sewage-disposal plant, pumping stations, etc.

COCHRANTON, PA.—Application, it is reported, has been filed with the Public Service Commission by Harley D. Carpenter of Crawford County for approval of contracts to supply electricity for lamps and motors to the borough of Cochranton and the townships of North, West and South Shenango and East and West Fallowfield.

EASTON, PA.—Plans have been completed by the Easton Hospital Association for the construction of a new power plant at the Easton Hospital at Lehigh and Twentieth Streets. The cost of the new hospital building and power plant is estimated at $150,000.

HARRISBURG, PA. — The Western Union Telegraph Company has petitioned the Public Service Commission for permission to install an underground conduit system in the central and eastern sections of the city to replace the overhead wires.

PHILADELPHIA, PA.—The Notaseme Hosiery Company, Mascher and Oxford Streets, is planning the construction of a power plant in connection with its proposed new mill to be erected at Atlantic and I Streets.

PHILADELPHIA, PA.—Bids, it is reported, are being received by G. C. Nimmons & Company, architects, South Michigan Avenue, Chicago, Ill., for construction of power house, also of a nine-story building, 360 ft. by 442 ft., and a six-story building, 80 ft. by 420 ft., to be erected in Philadelphia for Sears Roebuck & Company, Arthington and Homan Avenues, Chicago, Ill., to cost about $4,500,000.

PUNXSUTAWNEY, PA.—The Jefferson Electric Company has applied to the Public Service Commission for permission to operate in five additional townships and has asked for approval of charters in the various townships through which the transmission line from Dubois to Reynoldsville will pass. The new applications are for companies taking names from the districts for which they are to be incorporated, as follows: Kittanning, Mahoning, Plum Creek, Red Bank, South Bend, Sugar Creek, Valley, West Franklin and Toby Townships, Armstrong County; Clinton and Mercer, Butler County; and Brady, Madison, Perry, Porter, Piney and Red Bank Townships and East Brady, Rimmersburg and Hawthorne Boroughs, Clarion County. George A. Mau of Punxsutawney is manager of the Jefferson company.

READING, PA.—The Public Service Commission has granted the York Haven Water & Power Company permission to erect an electric-transmission line from Middletown to Annville to connect with the lines of the Metropolitan Edison Company of Reading at the latter place.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company, it is reported, is receiving bids for an addition to its Westport service stations. The company is also considering the erection of a new substation at Canton.

BALTIMORE, MD.—Contract has been awarded by the Eastern Rolling Mill Company for the construction of the initial unit, 360 ft. by 1000 ft., of its proposed plant, to cost about $500,000. Electrically operated equipment will be installed throughout the plant, energy to be supplied by the Consolidated Gas, Electric Light & Power Company of Baltimore. The plant complete may cost $5,000,000.

HUNTINGTON, W. VA.—The Consolidated Light, Heat & Power Company will erect a 11,000-volt transmission line from the Kenova power plant to Huntington, a distance of 6 miles, work to begin at once. The company will also build a 33,000-volt transmission line from the Third Street West substation to Twentieth and Second Avenue, East End, and will also construct a new 5000-kva. substation. John Hamback is superintendent of substation construction and D. L. Evans is line chief.

WASHINGTON, D. C.—Bids will be received at the office of the chief engineers, Procurement Branch, Equipment Section, Troop Division, Washington, D. C., until Oct. 11, under advertisement No. 17, for furnishing one switchboard, consisting of two 25-kw. generating panels.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Oct. 7, Philadelphia, Pa., Schedule 4658—4000 ft. single-conductor cable. Mare Island, Cal., Schedule 4672—seventy-six storage batteries; Eastern and Western yards, Schedule 4675—twelve motors. Until Oct. 10, Mare Island, Cal., Schedule 4659—five steam separators, reducers, tapes and brackets. Until Oct. 17, Eastern and Western yards, Schedule 4660—miscellaneous searchlight carbons. Until Oct. 21, Brooklyn, N. Y., Schedule 4684—15,000 ft. of cable.

## *Construction*

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

## North Central States

DETROIT, MICH.—Plans are being prepared by Brown & Preston, architects, Empire Building, for the erection of a factory building for the Michigan Machine Company, Sixteenth and Porter Streets, to cost about $150,000.

GRAND RAPIDS, MICH.—The Widicomb Furniture Company is building a 250-hp. power plant and storage pit for coal in connection with other extensions and improvements to its works.

IRONTON, OHIO.—The Ironton Electric Company will reconstruct its present transmission line to the Ironton Portland Cement Company, changing the voltage from 11,000 to 33,000, and will also build a new 3000-kva. substation. A new substation (33,000 volts) will also be erected at the Ironton Fire Brick Company, work to begin at once. The entire distribution system will be rebuilt and changed from two-phase to three-phase, work on which is now under way. John Hamback, with the Consolidated Light, Heat & Power Company, Huntington, W. Va., is superintendent of substation construction.

NORWOOD, OHIO.—The municipal pumping station and electric light plant was recently damaged by the explosion of a gas engine, causing a loss of about $50,000.

PIQUA, OHIO—Plans, it is reported, are being prepared by the J. J. Wernette Engineering Company for a new power plant for the French Oil Machinery Company in Piqua.

SANDUSKY, OHIO.—A 400-hp. B. & W. boiler, equipped with six-retort Riley stokers, diamond soot blower and other labor-saving devices, is being installed in the Lawrence Street plant of the Sandusky Gas & Electric Company. Owing to the great increase for electrical service, it is expected that it will be necessary to duplicate this battery during the coming winter. A new smokestack is being erected and the purchase of a new 3500-kw. turbo-generator is under consideration.

TOLEDO, OHIO.—The Reidon Company, recently incorporated with a capital stock of $100,000, has taken over the plant of the Toledo Chandelier Manufacturing Company and will manufacture electrical fixtures.

ASHLAND, KY.—The Boyd County Electric Company is building a new substation, equipped for 33,000 volts, at Twenty-fifth Street. When it is completed the old substation at Tenth Street will be abandoned. The new substation will also take care of the Ohio Valley Electric Railway equipment and the present substation at Clyffeside will be abandoned. The local distribution system will be changed from two-phase to three-phase and the entire system rebuilt, work on which has already commenced. John Hamback is superintendent of substation construction and D. L. Evans is line chief.

LOUISVILLE, KY.—The United Casket Company is planning to erect a new factory, 100 ft. by 440 ft., also a power house and dry kilns.

PADUCAH, KY.—At the election to be held in November the proposal to issue $100,000 in bonds for the improvements to the municipal electric light plant will be submitted to the voters.

ANDERSON, IND.—Arrangements are being made by the Union Traction Company of Indiana for improvements to its central power plant, involving an expenditure of about $100,000. The work will include the installation of new boilers and other equipment and overhauling the turbo-generators.

BLUFFTON, IND.—The Public Service Commission has authorized the city of Bluffton to issue $15,000 in bonds for improvements to the municipal electric light plant, including the purchase of a 1000-kw. turbine.

LOGANSPORT, IND.—The Logansport Utilities Company, which has taken over the plant of the Logansport Heat & Power Company from the receiver, is planning improvements this fall, to cost about $25,000.

BEMENT, ILL.—The property of the Bement Electric Light & Power Company has been purchased by J. B. Boers, T. E. Hughes and J. M. Capel of Champaign, Roscoe Lewis and George Neusome of Carbondale. The new owners contemplate extending the service to Sadorus, 10 miles distant.

CHICAGO, ILL.—Arrangements are being made by H. G. Fisher & Company, 2341 Wabausia Avenue, for the erection of a new plant, to cost about $70,000. The company manufactures X-ray machinery.

CHICAGO, ILL.—Plans have been prepared by Charles W. Kallal, architect, City Hall, for an electric plant to be erected by the city, to cost about $300,000. For further information address R. F. Francis, 401 City Hall.

CHICAGO, ILL.—Arrangements are being made by the Belden Manufacturing Company, 2300 Southwestern Avenue, for the erection of a new plant on West Van Buren Street, to cost about $100,000. The company manufactures electric wire cables.

CHICAGO, ILL.—The Federal Electric Company has engaged George C. Nimmons, architect, of Chicago, to prepare plans for a factory and boiler house, to be erected at the corner of State and Eighty-seventh Streets. The company manufactures electric vehicles.

GALENA, ILL.—The Interstate Light & Power Company, it is reported, will erect a 33,000-volt transmission line (10 miles long) to connect with the lines of the Lena Electric Light & Power Company near Apple River.

HILLSBORO, ILL.—Plans are being considered by the Southern Illinois Light & Power Company for the installation of additional machinery in its local power house to double the output of the plant.

LEE, ILL.—The Lee Power & Light Company, recently incorporated with a capital stock of $10,000, proposes to establish an electric light plant in Lee. David L. Heburg, James E. Johnson and Emanuel Anderson are among the incorporators.

LENA, ILL.—The Lena Electric Light & Power Company has entered into a ten-year contract with the Interstate Light & Power Company whereby the latter will furnish electricity to be distributed by the Lena company in Apple River, Warren, Nora, Lena, Pearl City, Shannon and Lanark.

NEW ATHENS, ILL.—The East St. Louis, Columbia & Waterloo Railway Company has been asked to extend its electric lines to New Athens.

SPRINGFIELD, ILL.—The City Council has decided to postpone submitting the proposal to issue $400,000 in bonds for extensions to the municipal electric light plant from Sept. 10 until Nov. 4, the date of the regular election.

SPRINGFIELD, ILL.—The Davenport, Springfield & Southern Railway Company has applied to the Public Utilities Commission for a certificate of convenience and necessity to construct and operate an electric interurban railroad from Davenport, Iowa, to Metropolis. The company also proposes to build a branch line from Binckneyville, Ill., to East St. Louis and to construct several other spurs.

URBANA, ILL.—The contract for the installation of the ornamental lighting system in the southwest part of the city, adjacent to the University of Illinois, has been awarded to the Freeman Sweet Company of Chicago, at about $26,000.

JANESVILLE, WIS.—The Janesville Electric Company, it is reported, is asking for new bids for a steam turbine of about 2000 hp. capacity.

ADAMS, MINN.—A special election will soon be held to submit to the voters the proposal to establish a municipal electric light plant in Adams.

FAIRMONT, MINN.—Bids will be received by the Water and Light Commission until Oct. 7 for the construction of a municipal electric light, power and heating plant. The power house will be 83 ft. by 83 ft., with engine room equipped with traveling crane; also boiler room with arrangements for future overhead coal bunkers. Plans are on file at the office of the Water and Light Commission and at the office of Silas Jacobson, architect, Endicott Building, St. Paul. E. W. Bird is secretary of light and water commission.

CENTRAL CITY, IOWA.—The Electric Service Company, it is reported, is extending its transmission lines to Quasqueton.

DUBUQUE, IOWA.—The Eastern Iowa Electric Company of Dubuque is contemplating extending its electric transmission lines from Peosta to points in Vernon, Prairie Creek, Whitewater and New Wine townships.

WEST LIBERTY, IOWA.—The Town Council has decided to call an election to submit to the voters the proposal to issue $38,000 in bonds for the purchase of new machinery for the municipal electric light plant.

INDEPENDENCE, MO.—Bonds to the amount of $60,000 have been voted for extensions to the municipal electric light plant.

KANSAS CITY, MO.—The Murray Grain Elevator was recently destroyed by fire, causing a loss of about $500,000.

ST. LOUIS, MO.—An ordinance is being prepared by the Department of Public Utilities requesting an appropriation of $300,000 for improvements to the city lighting system. The plans include replacing the naphthalin lamps now in use in the city parks and on many streets in the residential districts with electric lamps.

GUIDE ROCK, NEB.—Bonds have been authorized for the installation of an electric lighting system in Guide Rock.

TOPEKA, KAN.—Bids will be received by the State Board of Administration, addressed to James A. Kimball, business manager, State House, Topeka, until Oct. 15, for furnishing all labor and materials for electric wiring in the main building, dining room and officers' quarters building and "A" and "B" cottages at the Boys' Industrial School, Topeka. Plans and specifications may be seen at the office of R. L. Gamble, state architect, State House, Topeka.

WINFIELD, KAN.—Improvements involving an expenditure of $45,000 are contemplated to the municipal electric light plant.

## Southern States

MURPHY, N. C.—Plans are under consideration by the town officials for the construction of a hydroelectric power plant to develop from 500 hp. to 700 hp. The cost of the plant is estimated at about $75,000.

SIMPSONVILLE, S. C.—An election will soon be held to submit to the voters the proposal to issue $15,000 in bonds for the installation of an electric lighting system.

TIFTON, GA.—The installation of an electric light plant in Tifton is under consideration. L. P. Thurman is interested.

LEESBURG, FLA.—The ice and electric plant of the Leesburg Ice Company has been taken over by the city. No extensive improvements are contemplated for the present. The plant will be under the management of W. M. Francisco, city manager of public utilities.

GREENFIELD, TENN.—The City Council is considering calling a special election to submit to the voters the proposal to issue $700,000 in bonds for installation of waterworks system and power house.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company will erect a new substation equipped with one 1000-kw. rotary converter, together with switchboard, to supply 250-volt energy to Edison service. L. L. Newman is engineer in charge.

BRUNDIDGE, ALA.—G. L. Beck, owner of the local electric light plant, is considering the installation of a small generating unit.

GADSDEN, ALA.—Contract has been awarded by the Alabama Power Company of Birmingham to the Dixie Construction Company of Birmingham for the erection of an electric transmission line from Gadsden to Huntsville, and also a line from Huntsville to Decatur.

IRONDALE, ALA.—An election will soon be held to vote on the proposal to issue $5,000 in bonds to provide funds for the erection of an electric transmission line to connect the town with the transmission system at Red Gap Junction to secure electrical service here.

MADISON, ALA.—W. A. Thomas is reported to be in the market for equipment for an electric plant sufficient to maintain from 300 to 500 lamps.

SPRINGDALE, ARK.—Bonds to the amount of $200,000 for the installation of lighting, water and sewer systems have been voted.

CROWLEY, LA.—Electric lighting, sewer and water extensions, to cost about $20,000, for a suburban development, are under consideration by P. L. Lawrence.

AFTON, OKLA.—Improvements to the municipal electric light plant, to cost about $10,000, are under consideration.

BILLINGS, OKLA.—The Greater Oklahoma Oil Corporation is reported to be in the market for a 200-kw. generator and a 75-hp. engine. G. B. Sherritt is president.

GALVESTON, TEX.—The City Commission has instructed W. D. Masterson, city electrician, to prepare plans for a proposed municipal electric light and power plant in Galveston. The proposal to install a municipal plant will be submitted to the voters at an election to be held early next year.

CLINTON, TEX.—The property of the Clinton Electric Light & Power Company has been purchased by Hale Brothers. The new owners, it is said, will erect a flour mill at the plant.

## Pacific and Mountain States

SEATTLE, WASH.—The A. Kristoferson Company, Eastlake Avenue, is contemplating the construction of a milk plant, including refrigerating plant, mechanical carriers, elevators, power and compressed air plants, etc., to cost, exclusive of equipment, about $50,000. E. Story, New York Building, Seattle, is architect.

CHICO, CAL.—The City Trustees are considering the question of requiring the power companies to place their overhead wires underground on the streets that are to be paved.

MARC ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., in the near future, under Specification 3982, for electric lighting and power system for structural shop at Mare Island, to cost about $25,000.

MARYSVILLE, CAL.—The Marysville & Nevada Power & Water Company is planning the construction of a hydroelectric plant at Bullard's Bar. The company proposes to supply electricity in Marysville, Sacramento and other places in this district. The headquarters of the company are in Marysville.

PLUMMER, IDAHO.—Plans are under consideration for the installation of a municipal electric lighting system in Plummer. It is proposed to connect with the transmission system of the Washington Water Power Company at Tekoa, 16 miles distant. The cost of the proposed line is estimated at about $8,000.

BENSON, ARIZ.—The Arizona Smelting & Power Company will soon install an electric generating plant in Benson. The company has contracted to supply power to the town.

HARDIN, MONT.—The property of the Hardin Electric Light & Power Company has been purchased by F. V. B. Collins and R. G. Schaefer. Improvements are contemplated by the new owners, including increasing the boiler capacity by 250 hp. The primary circuits are to be extended to include every portion of the city and suburbs. A twenty-four-hour service is also planned, and the plant will be equipped to furnish electricity for power as well as lighting purposes.

TONOPAH, NEV.—The Tonopah-Divide & Goldfield Electric Railway Company, recently organized, is planning to build an electric railway from Pevert claim to Tonopah, a distance of about 6 miles. R. W. Cattermole of Goldfield is chief engineer.

## Canada

SWAN RIVER, MAN.—Tenders, it is understood, will soon be asked for the construction of an electric light and power plant in Swan River.

HALIFAX, N. S.—Arrangements are being made by the Water Power Commission of Nova Scotia to supply the Province of Nova Scotia with a hydroelectric power system. It is estimated by the government engineers that there are streams in the province capable of developing at least 500,000 hp. and that they have in sight waters available for the development of 250,000 hp.

GUELPH, ONT.—The Wendigo Power Company, recently incorporated, contemplates developing hydroelectric power on Wendigo Lake and certain parts of the Blanche River, including the storage rights on upper waters. The proposed plant will be located about 20 miles south of Larder Lake. The present plans provide for an ultimate development of from 3000 hp. to 4000 hp.

TORONTO, ONT.—Arrangements are being made by the Hydroelectric Power Commission for the installation of an electric lighting system in the Woodbine Heights district of York Township.

WELLAND, ONT.—The City Council has adopted a bylaw providing for extensions and improvements to the hydroelectric power system, to cost about $35,000.

UNITY, SASK.—Bids will be received by J. M. Jensen, secretary and treasurer of the town of Unity, until Oct. 15, as follows: (A) For furnishing and erecting one internal-combustion engine; (B) for furnishing and erecting one generator, exciter, switchboard, transformers, meters, etc.; (C) for one oil-storage tank; (D) for furnishing poles, wire and line material; (E) for erection of pole line; (F) for erection of power station and cooling chamber. Plans and specifications may be seen at the office of the secretary and treasurer of Unity and at the office of Murphy & Underwood, consulting engineers, Saskatoon.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, Nepecnauk Bldg., 63 East Adams St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City. Annual meeting, Oct. 6-10.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, N. Y. City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS OF ONTARIO. Secretary, R. A. Clement, 190 University Ave., Toronto, Ont., Can.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St., East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, F. O. Safford, Denver Gas & Electric Co., Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 110 West 40th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, W. C. Briggs, Shepard Electric Crane & Hoist Co., New York.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 38th St., New York City. Annual meeting, New York City, Oct. 9.

# *Directory of Electrical Associations*

Printed in the First Issue of Each Month

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill. Annual convention, Chicago, Ill., Oct. 23 and 24.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Chicago, Oct. 21-24.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Chicago.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), J. F. Strickland, Dallas, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary and treasurer, Meyer Barnest, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary, E. S. Meyers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 6, 1920.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Springfield, Mass., Oct. 13 and 14.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, W. E. Herring, 860 Stuart Bldg., Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 171 Second St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TECHNICAL AND HYDROELECTRIC SECTION OF THE N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

# Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 9, 1919)

1,315,203. CONNECTOR FOR ELECTRIC CIRCUITS; Carl Bramming, Chicago, Ill. App. filed Jan. 18, 1917. Bayonet-joint lock.

1,315,796. CONNECTION WITH BRUSHES FOR ELECTRIC MOTORS OR DYNAMOS; William H. Scott, Norwich, Eng. App. filed May 20, 1915. Ignition, internal-combustion engines.

1,315,862. RADIO-SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed Jan. 17, 1918. Arrangement and disposition of antennas.

1,315,867. ELECTRICAL APPARATUS; Ivanhoe H. Sclatter, Pittsfield, Mass. App. filed Dec. 24, 1917. Cores have "air gaps" in magnetic circuit.

1,315,876. ELECTRIC WELDING MACHINE; Albert W. Southall, Buffalo, N. Y. App. filed July 26, 1918. Permits operator use of both hands.

1,315,886. METHOD OF OBTAINING SPARKLESS BREAKS OF ELECTRIC CIRCUITS; Thomas F. Wall, Edgbaston, Birmingham, Eng. App. filed April 19, 1916. Objectionable effect of resistance obviated.

(Issued Sept. 16, 1919)

1,315,936. METHOD OF CONSTRUCTING ARMATURES AND THE LIKE FOR DYNAMO-ELECTRIC MACHINES; V. G. Apple. App. filed Dec. 30, 1916. Core of short segments of laminas.

1,315,939. ELECTRO-WELDING MACHINE AND PROCESS; Clair M. Agnew, Milwaukee, Wis. App. filed Aug. 22, 1913. Interrupts current while pieces to be united are subjected to pressure.

1,315,950. CONTACT FINGER AND BASE; Isidor Deutsch, Cincinnati, Ohio. App. filed Feb. 21, 1914. Controlling mechanisms protected from abnormal stresses.

1,315,953. TELEGRAPH CIRCUIT; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 3, 1916. Protecting the operating instruments of circuits from inductive disturbances.

1,315,957. FIELD-CONTROLLING MEANS FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 29, 1915. Adapted for alternating-current motors of the compensated commutator type.

1,315,958. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 12, 1916. Double-commutator auxiliary machine.

1,315,959. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 8, 1916. Regenerative system.

1,315,965. STARTING DEVICE FOR ELECTRIC MOTORS; Oliver S. Jennings, Wilkinsburg, Pa. App. filed June 5, 1916. Interrupts circuit of starting winding of an induction motor.

1,315,968. METHOD OF MAKING CONDENSERS; Willard H. Kempton, Wilkinsburg, Pa. App. filed March 7, 1919. Chlorinated naphthalene process.

1,315,975. ELECTRICAL DEVICE; Paul M. Lincoln, Pittsburgh, Pa. App. filed June 5, 1916. Uniform torque.

1,315,982. PROCESS FOR EXTRACTING METALS; Ernest Moulton, Salt Lake City, Utah. App. filed April 18, 1916. Separates zinc from acid solutions.

1,315,990. CONTROL SYSTEM; Theodore H. Schepf, Pittsburgh, Pa. App. filed May 8, 1916. For motor trucks with battery system.

1,315,992. ELECTRODE FOR ELECTRIC FURNACES; Paul Sejournet, Paris, France. App. filed Dec. 9, 1918. Distribution of current in the different parts of the electrode.

1,315,996. CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, Pa. App. filed Aug. 9, 1915. Prevents high temperatures in ventilating-type apparatus.

1,315,998. INSULATOR - SUPPORT THIMBLE; George T. Southgate, Brooklyn, N. Y. App. filed Oct. 20, 1916. Avoids excessive mechanical stresses.

1,316,004. INDUCTION - MOTOR WINDING; Harold E. Trent, Harpenden, Eng. App. filed July 11, 1914. Squirrel-cage type.

1,316,009. AUTOMATIC SWITCHING ARRANGEMENT FOR ELECTRIC MOTORS; Clifford A. M. Weber, Edgewood Park, Pa. App. filed July 11, 1916. Reverses motor.

1,316,034. STORAGE-BATTERY CONNECTION; Clarence W. Hazelett, Lakewood, Ohio. App. filed Nov. 21, 1917. Terminal for attaching cable.

1,316,035. STORAGE-BATTERY-FILLING VENT; Clarence W. Hazelett, Lakewood, Ohio. App. filed Feb. 20, 1918. Vent plug.

1,316,093. REVERSING MECHANISM; Fritz W. A. Henrici, Boston, Mass. App. filed April 12, 1916. Effects periodical reverse motion of cams.

1,316,095. ELECTRICAL CUT-OUT; William H. Illingworth, Halifax, Eng. App. filed Nov. 13, 1918. Connection restored by tilting the mercury apparatus.

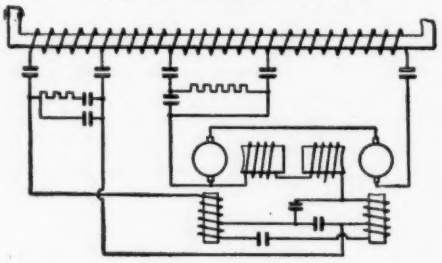
1,316,101. TELEPHONE-EXCHANGE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed May 6, 1910. For both manual and automatic apparatus.

1,316,110. MAGNETIC TRANSMISSION GEARING; John T. Ronan, Ludwig, Nev. App. filed Feb. 13, 1917. Electrical control circuit.

1,316,121. VEHICLE SIGNALING DEVICE; Edwin M. Taylor, Cedar Rapids, Iowa. App. filed Aug. 17, 1918. Indicates direction of conveyances.

1,316,158. PUSH-BUTTON; Lee P. Hynes, Albany, N. Y. App. filed Dec. 21, 1916. Removable cover.

1,316,161. ELECTRIC HEATER; Frank E. Karg, Youngstown, Ohio. App. filed Sept. 17, 1918. Electrical furnace.



1,315,957—Field Controlling Means For Dynamos

1,316,167. SIGNAL-CARRYING FUNNEL; John P. Lecrone, York, Pa. App. filed Nov. 27, 1918. Prevents overflow.

1,316,172. RADIO-TELEGRAPHY; Roland G. Marx, Palo Alto, Cal. App. filed Aug. 13, 1917. Signaling involving extinguishing and reigniting the arc.

1,316,188. RADIO - SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed March 28, 1919. Radio conductor located partly or entirely beneath the surface of the earth.

1,316,190. DEVICE FOR THAWING FROZEN PIPES AND THE LIKE; Ernest A. Sackerman, Hackensack, N. J. App. filed Feb. 6, 1918. Applicable to different sizes of pipes.

1,316,204. BRAKE SYSTEM; Walter V. Turner, Wilkinsburg, Pa. App. filed Feb. 20, 1918. Fluid-pressure brakes for railways.

1,316,207. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed June 5, 1918. Controls brakes independently.

1,316,218. CONVERTIBLE METER BOX; Harvey E. Bloomer, Milwaukee, Wis. App. filed May 22, 1916. W-ll portions interchanged to adapt the box to different conditions.

1,316,220. NEW COMPOUND SHOWING VARIABLE RESISTANCES UNDER THE INFLUENCE OF LIGHT; Theodore W. Case, Scipio, N. Y. App. filed Feb. 19, 1917. Consists of bismuth and sulphur.

1,316,229. INTERNAL-COMBUSTION ENGINE; John E. Gilson, Port Washington, Wis. App. filed April 30, 1914. Movement of armature magneto produced at a desired speed and proper time.

1,316,233. DRY CELL; Clarence W. Hazelett, Lakewood, Ohio. App. filed May 9, 1919. Seamless-zinc can containers.

1,316,244. MAGNETO - TESTING APPARATUS; Thomas S. Kemble, Buffalo, N. Y. App. filed Sept. 16, 1918. Corrects for preignition or late ignition.

1,316,246. PORTABLE SEARCHLIGHT; James W. Knoblock, Elmira, N. Y. App. filed July 5, 1917. Transmits telegraphic signals.

1,316,305. AUTOMATIC ELECTRIC SWITCH; Henry A. Hoeschen, Omaha, Neb. App. filed Nov. 22, 1918. Operates compressor for a refrigerant.

1,316,308. ELECTRIC SWITCH; William A. Kirscht, St. Cloud, Minn. App. filed July 17, 1917. For closing circuit to engine and electrical appliances on automobile.

1,316,312. SIGNALING SYSTEM; William R. McNary, Detroit, Mich. App. filed Nov. 9, 1917. Combined automatic and manually operated.

1,316,319. REFILLABLE CARTRIDGE FUSE; Hugo P. Niesen, Buffalo, N. Y. App. filed Feb. 4, 1918. Ferrule type.

1,316,321. METHOD OF CONSTRUCTING RESISTANCE GRIDS; Clarence E. Ogden, Cincinnati, Ohio. App. filed March 21, 1919. Perfect contact when arranged in banks.

1,316,331. MULTIPLE-FUSE PLUG; Elon G. Rogerson, Calgary, Alberta, Canada. App. filed May 17, 1918. Operates a given number of times.

1,316,334. WIRE HOLDER FOR ELECTRIC WELDING; Adolf Schneider, Brooklyn, N. Y. App. filed May 28, 1916. Two electrode bars with offset lug at one end for grasping wire.

1,316,341. ELECTRIC VOLUME INDICATOR FOR TANKS; James A. Vosika, Olivia, Minn. App. filed June 27, 1917. Operated from battery.

1,316,342. OZONE GENERATOR; Albert E. Walden, Baltimore, Md. App. filed Jan. 29, 1916. Water-cooled.

1,316,350. LIGHT-REACTIVE RESISTANCE AND METHOD OF FORMING SAME; Theodore W. Case, Scipio, N. Y. App. filed April 5, 1918. Oxidized compound of thallium and sulphur utilized.

1,316,361. ELECTRIC CONTACT THERMOSTAT; Harry G. Geissinger, New York, N. Y. App. filed Jan. 19, 1918. Deflection of the arch element by expansion due to temperature controlled.

1,316,368. ELECTRICALLY HEATED TOOL; Frank Kuhn, Jay A. Hand and Jules G. Spies, Detroit, Mich. App. filed Jan. 25, 1919. Detachable soldering point.

1,316,372. HEADLIGHT-CONTROL SWITCH FOR MOTOR VEHICLES; Oscar P. Liebreich, Troy, N. Y. App. filed Oct. 22, 1917. Controls the degree of illumination.

1,316,383. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed May 21, 1919. Welds a metal inner tube within an outer metal envelope.

1,316,384. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed May 21, 1919. Uniting a metal inner tube and a metal outer inclosing tube.

1,316,385. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed May 21, 1919. Uniting a metal inner tube and a metal outer inclosing tube.

1,316,386. METHOD OF UNITING METAL RODS TO METAL PLATES; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed May 31, 1919. Internal bracing or staying of gas tanks.

1,316,393. FLASHLIGHT - BATTERY TESTER; Robert M. Schoppert, Eutaw, Ala. App. filed Jan. 30, 1919. Separate contacts for each type of battery.

1,316,429. THERMIC TIMING ELEMENT; David Danielsson, Vasteras, Sweden. App. filed April 10, 1918. Independent of temperature fluctuations.

1,316,431. PORTABLE LIGHTING DEVICE; Robert Dixon, Armells, Mont. App. filed April 29, 1918. Locating trouble on automobiles.

1,316,445. APPARATUS FOR FIXATION OF ATMOSPHERIC NITROGEN; James S. Island, Hamilton, Ontario, Canada. App. filed Nov. 15, 1917. Maximum flame area for given electrical pressure.

1,316,459. ELECTRIC LAMP SOCKET; Arvid H. Nero, New Britain, Conn. App. filed April 7, 1917. Single pair of screw bolts used.

1,316,470. STREET INDICATOR; Walter A. Wilson and Sydney Wilson, Vancouver, British Columbia, Canada. App. filed Aug. 5, 1918. Indicates successive stations.

1,316,477. TELEPHONE SYSTEM; Hiram D. Currier, Chicago, Ill. App. filed Oct. 1, 1913. Service meter-control circuit in combination with a ringing key and relays.

1,316,484. VAPOR ELECTRIC RECTIFIER; Julius Jonas, Baden, Switzerland. App. filed Aug. 1, 1914. Electromagnetic means excited by direct current and by alternating current.